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# A PROPOSED METHOD OF OPEN-WIDTH BLEACHING FOR COTTON PIECE GOODS

P J WOOD
*Technical Director*
*Royce Chemical Company*
Carlton Hill, N J

## HISTORICAL

IN the past, it has been customary to desize cotton goods by impregnating them with the desizing liquor, after which they were piled in a bin or plaited down in closed-side trucks for several hours to complete the conversion of the starch used in warp sizing into dextrines and or sugar.

This operation was followed by washing with hot and cold water to remove the products of decomposition.

The next operation consisted in piling the goods into kiers, where they were boiled in caustic soda solution, with or without the addition of other alkalies, such as silicates or phosphates and other auxiliaries, soluble oils, pine oil soaps, etc. The object of this treatment was to remove oils and waxes by emulsification and saponification and to eliminate such of the chromophores as are removable by this means. This operation was conducted under pressure and took anywhere from 8-10 hours.

More recently this object was accomplished by means of the so-called continuous caustic boil-off. This machine was a sort of multiple jigger. The goods were beamed on the first roll, the yardage it was possible to accumulate on this roll depending on the weight and thickness of the cloth. When the first roll was full, the end was passed from this roll to the next succeeding roll; when this was all rolled off the first roll, the next batch of new desized cloth was rolled onto the first roll. By the time the first roll was full again, the cloth from the third roll was already running onto the fourth roll. These large beams of cloth ran successively from roll 1 to roll 2, from roll 2 to roll 3, roll 3 to roll 4, from roll 4 to roll 5. When the entire machine was full of cloth, the last roll, No. 5, was ready for doffing. The end of the cloth was passed through a squeezer at the end of the machine and the goods plaited down in a box truck ready for the following operations of hot and cold washing, chlorine bleach, washing, souring, washing and drying.

From this it will be seen that the caustic boil, effected in this way, was more or less continuous, although not wholly so, and that the goods were kept in the open width, *and length*, as contrasted to the kier boiling, which had to be done in the rope form. Once the machine was filled, it remained filled with goods until completion of the run. The period on this machine was about *4 hours* as compared with *8-10 hours* on the kier, which, incidentally, was sometimes repeated, in the case of some types of goods.

Still more recently, a patent was taken out for a rearrangement of this multiple jigger type of boil-off machine, which was said to make it possible to reduce the time to *2½ hours*. (See Fig 1.)

The latest form of apparatus used for this purpose consists of a form of J box into which the goods already impregnated with caustic soda solution and the other chemicals previously mentioned, are introduced and subjected to the action of steam. The time usually allotted to this treatment is 1 hour in the steam J box. The DuPont and Becco methods of caustic steaming are slightly different. The DuPont method is to pass the cloth through a "steam well", which heats it up to the required temperature, after which it is stored in the insulated J box, whereas the Becco system calls for piling the impregnated goods into the steam J box, where steam is actually applied.

Although the name *continuous open-width bleaching* has been applied to the passing of goods through these machines, when, instead of run-

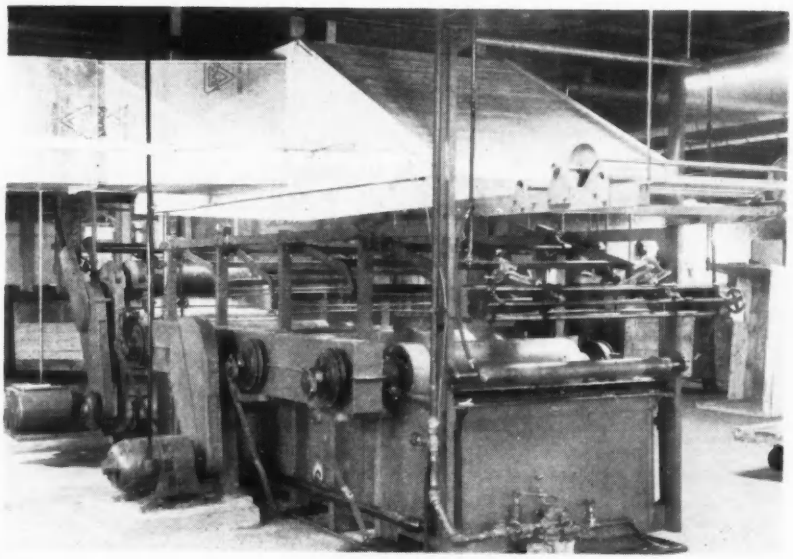

**Figure 1**
**Multiple-jig type of open-width caustic boil off. Mill picture showing squeezer.**

ning the cloth in in rope form, it is plaited down into the apparatus in the open width, it does seem that to be truly open width in character, the goods should also be kept "open length", otherwise creases are liable to develop, which might give rise to unevenness of application of the steam where the steam is applied in the J box, or to uneven cooling down of the cloth in the case of the using of the J box for storage of the previously heated and impregnated cloth.

Before initiating the experiments that will be described in this paper, the writer was of the opinion that it would be possible to reduce the time of steaming if the goods could be treated not only *"open width"* but also *"open length"*, so that the condition of every part of the surface of the goods being treated would be as uniform as possible.

After being washed and neutralized, the goods are bleached. In the case of kier-boiled goods it was usual to impregnate the washed goods with calcium or sodium hypochlorite and then lead them into a bin, where they were allowed to lie for several hours, during which time the bleaching gradually took place. Next the cloth was washed, soured, washed again and sometimes treated with an antichlor to remove the last traces of chlorine. Modern method is to impregnate the goods with a solution of hydrogen peroxide in the kier, specially treated so that the iron, of which the kier is made, will not affect the peroxide. The most modern method is to impregnate the cloth with peroxide together with the necessary auxiliaries, stabilizers, etc., and to pass the goods into another J box for steaming. Subsequently they are washed thoroughly, neutralized and washed again and dried.

Another method of caustic steaming involving the use of a conveyor within a steam box was introduced by Mathieson Chemical a little over 10 years ago. The original conveyor consisted of a series of parallel ropes, looking for all the world like a rope-race, at one time used for the main drive from Corliss engines, and the like. This was soon replaced by a solid-hinged perforated plate conveyor, which seemed to be more practical. This was operated by dropping the impregnated goods onto the conveyor in the steam box (*1*). When visiting a Southern bleachery, the writer was told by the superintendent that he could see the crush marks resulting from the crumpling of the goods piled up on the conveyor. The writer suggested that it would be possible to eliminate these marks by making a three-tier conveyor, so that the goods would be dropped from the top tier onto the next lower conveyor,

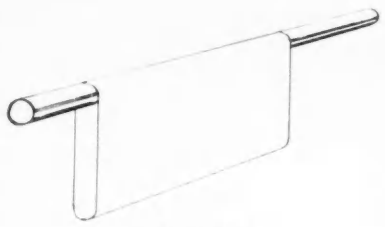

**Figure 2**

moving in the opposite direction, and from this second tier down onto the third tier conveyor moving in the same direction as the top tier, thus bringing the goods out at the same end of the apparatus as when one single conveyor was used.

The machine as illustrated nowadays is a multiple-tier steamer.

In spite of the fact that there is undoubtedly a saving to be made by adoption of the continuous system of cotton bleaching, the British do not seem to approve this method, claiming that the results are not as good. On a recent visit to the British Isles, the writer was unable to find any news of the installation of this type of apparatus in any English or Scottish works, although a *full open-width* bleaching range of rather a unique type evidently is running successfully in Northern Ireland.

Experiments carried out at the Southern Regional Research Laboratory (*2*) indicate . . . "The caustic soda kier boil and hypochlorite bleach yielded fabrics with lower amounts of residual impurities (alcohol-soluble materials, wax, and ash), with higher cellulose content, than the fabrics from either of the other two processes. The continuous process showed slightly lower amounts of residual impurities, with slightly higher cellulose content, than fabrics from the caustic soda kier boil and hydrogen peroxide kier bleach."

The three general classes of bleaching methods were: caustic soda kier boil and hypochlorite bleach; caustic soda kier boil and hydrogen peroxide kier bleach; and continuous bleaching.

This publication is well worth reading. It finally concludes . . . "Although each of the three classes of bleaching had some disadvantages, all were satisfactory and produced fabrics of good commercial quality."

## EXPERIMENTAL

In order to set about solving the problem of an improved method of bleaching in the open width, it was necessary to undertake experimental work with a view of establishing certain data not available in the literature.

Take, for instance, the matter of steaming time for caustic treatment of the goods. In general, the usual practice in continuous bleaching of the rope-form type, was to allow a period of 1 hour in the steamer, although Ariente (*1*) mentions a period of forty-five minutes for what we may call the "caustic steam" and the same length of time for the "bleach steam." The reduction of the steaming period was evidently due to the form of the new steaming apparatus, which apparently gave better exposure to the steam, on account of the different disposal of the goods in the steam box.

So these experiments regarding determination of the minimum time required in the caustic steam, started with 64 minutes maximum exposure, to represent the 1-hour exposure in the J box type of steamer. 64 minutes was chosen as it could be more easily divided than 60 minutes. This period was varied as follows: 64, 32, 16, 8, and 4 minutes.

The next variable tackled was that of temperature. Very little had been published, at that time, regarding this element. Here, starting from a minimum temperature of 212° F, the temperature was stepped up to 220, 240, 260, 280.

Arbitrarily a 3% caustic solution was used, with small additions of silicate and sulfonated castor oil (to soften the motes).

The apparatus used was a laboratory steam box with a system of circulation of steam, which could be freed of air, the temperature of which could be regulated at will.

The desized cotton cloth was sewn into the form of a ring (Figure 2) and inserted into the steam box on a stainless-steel rod, which could be thrust through a hole in the door of the box, and observed through a sight glass alongside of the door. All the time the cotton was in the box, the rod was rotated by hand, continually changing the point of suspension.

On a table, at the side of the steamer, were several crocks containing 1) hot water, 2) hot water into which was led a current of $CO_2$, 3) and 4) hot and cold water.

## MODUS OPERANDI

The cloth, previously weighed dry, already sewn into a ring, was impregnated with the caustic liquor, squeezed through a household rubber-roller wringer, and weighed to check the take-up of liquor, which was regulated as near as possible to 100% on the weight of the goods.

The ring of cloth was rapidly put on the rod, which had already been inserted through the tightly fitting hole in the door of the steamer and quickly

pushed into the apparatus and the door tightly closed. The rod was turned by hand and the goods observed through the sight glass to insure that no creases developed. At the completion of the steaming period, determined by stopwatch, the door was opened and the rod and sample removed and immediately plunged into hot water in the first crock. After being stirred well in this bath for a short but specified length of time, it was removed, squeezed rapidly and introduced into the second crock supplied with a constant stream of carbonic acid gas. After being squeezed, it was then washed in crocks 3 and 4 containing hot and cold water, squeezed and dried.

Very early in the series of trials, it was determined that the highest temperature did not produce a desirable result, especially at the longer periods, 32 and 64 minutes, as the samples were dry as they issued from the steamer. The higher temperature steam had actually dried them, defeating the object of this operation.

When a set of the caustic-boiled goods was completed, it was subjected to bleaching by impregnation with silicate-stabilized peroxide baths of 3-volume strength. The samples were treated as described for the caustic-soda impregnation except for the change of composition, and steamed for varying periods of time from 64 minutes down to 4 minutes.

On emerging from the steam box the samples were washed quickly in hot water, neutralized and washed again in cold water, and dried.

## CONCLUSIONS

TEMPERATURE — CAUSTIC STEAM———After several experiments at the range of temperature given above, it was found that there was danger in running the goods at high temperatures for protracted periods of time, as the caustic soda solution actually dried into the goods, a consummation to be avoided. So the greater part of the work was done at the two lower temperatures. It was considered that the optimum temperature lay somewhere *between 212 and 220° F.*

TIME — CAUSTIC STEAM ——— This point could only be decided after the samples were carried through the entire series of operations, and the conclusions regarding time were based on the whiteness of the causticized and bleached samples. Using this as a yard stick, it was found that the difference between 16 minutes in the caustic steam and 32 minutes was negligible. Both registered better than 90 on the Hunter Reflectometer, which, we understand, assures a good white after bluing and finishing. So the minimum caustic steam time was set at *16 minutes.* It could be just as well 15 minutes, as the difference between the 16-minute and 8-minute samples was not too great.

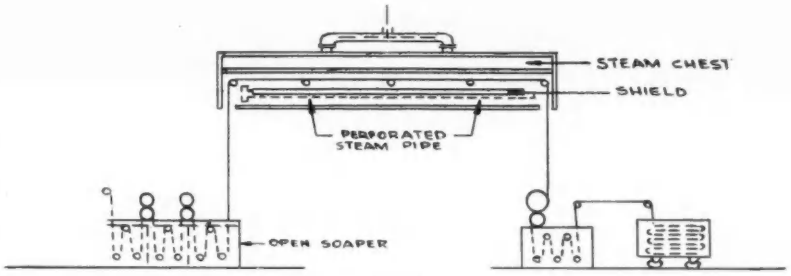


**Figure 3**
**Continuous desizing**

TEMPERATURE — BLEACH STEAM———In the same way, by inspection of the finished goods and evaluation on the Hunter Reflectometer, it was found that *there was hardly any difference between 8-minute bleach steam and 4-minute bleach steam,* for the particular cloth on which the experiments were made, 80 x 80, 4-oz cotton goods. It is likely that experiments would have to be made in the case of cloths that differ greatly from this standard construction.

TIME—BLEACH STEAM———The best reflectance was obtained using a temperature of 212° F or a little higher; it was certainly not necessary to go to the high temperatures originally tried.

*Note A*: **It is probably safe to hazard a guess that the optimum temperature for the steaming of the impregnated fabric in each operation would probably be in the region of the boiling point of the solutions respectively.**

*Note B*: **Through the window of the steam box the change in color of the sample could be readily observed, as the box was illuminated from within. It was noted that the original brownish color of the caustic-impregnated cloth changed gradually to a fairly bright canary yellow. If the hot cloth, on removal from the box, was allowed to remain exposed to the air, it changed to a darker color, probably not as dark as the original color of the caustic-impregnated cloth, but very much darker and browner than it was at the moment of emergence. On the other hand, if it was plunged immediately into hot water, and the caustic washed out, it came out considerably lighter than the cloth that was first allowed to "rebrown" in the air, before washing. This indicated the importance of getting the causticized and steamed cloth into the wash water without prior exposure to oxidation.**

## THE PROPOSED APPARATUS

The apparatus consists of four main parts, as follows:

1) **The desizer.**
2) **The festoon type continuous steaming chamber (boil-off).**
3) **The carbonic acid neutralizing chamber.**
4) **The shorter festoon type continuous steaming chamber (bleach).**

This machine (see Figure 3) consists of a desizing tank with multiple idler rollers furnished with an *open* steam pipe for heating, regulated by a convenient type of automatic temperature controller. The device comprises a pair of squeeze rollers of simple construction, capable of being adjusted so that the goods can be made to take up 100% of their weight of the desizing liquor. From the squeezer, the goods pass directly into a steamer, as illustrated, and on emerging at the end of the single passage through this box they pass into an open-width washing machine through hot water, to remove the products of decomposition of the starch, and from this point directly into the caustic impregnation tanks (see Figure 4), three in number, undergoing several dips in each tank, followed by a good squeeze, the last nip of which should leave 80-90% liquor in the goods. This last set of squeeze rollers, and the final part of the tank which they serve, are located within the steamer, the wall of the steamer dipping into the bath so as to form a water-seal, not so much to keep in the steam but rather to prevent ingress of air, as a measure against formation of oxycellulose in the goods. A conventional form of festooning device leads the goods through this part of the range, at the end of which the goods enter into the first part of a hot water open-width washer, into which the wall of the steamer dips to form a water-seal, for the reasons given above.

The festoon steamer is provided

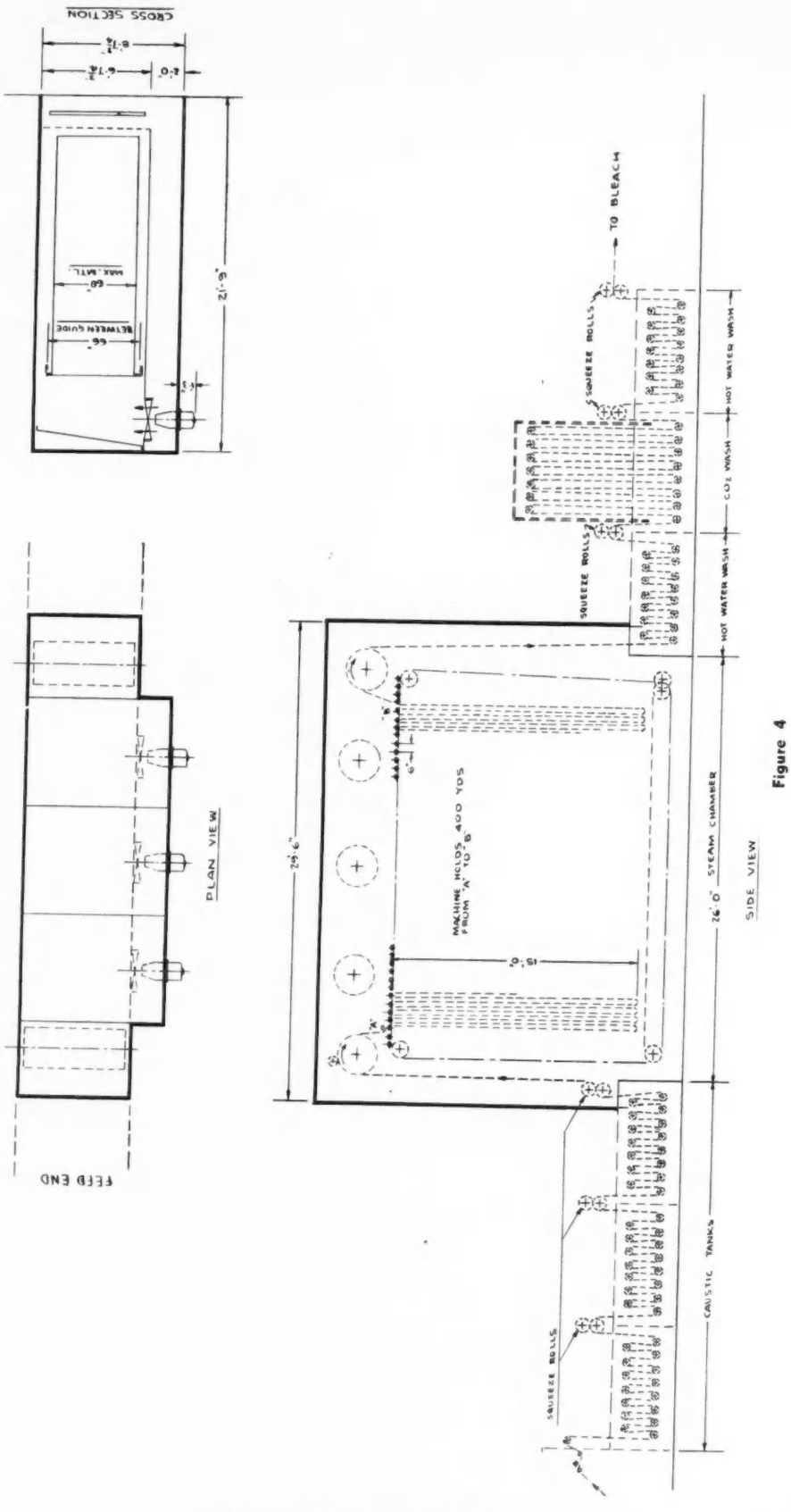
CROSS SECTION
BETWEEN GUIDE
MAX. MTL.
21'-9 1/2"
FEED END
PLAN VIEW
TO BLEACH
SQUEEZE ROLLS
HOT WATER WASH
CO2 WASH
HOT WATER WASH
SQUEEZE ROLLS
MACHINE HOLDS 400 YDS FROM 'A' TO 'B'
29'-6"
26'-0" STEAM CHAMBER
CAUSTIC TANKS
SQUEEZE ROLLS
SIDE VIEW

Figure 4

with a steam pipe, running along its entire length, through which steam is supplied at the correct temperature; this pipe is perforated to supply steam evenly to all parts of the chamber. It is covered with a protecting perforated cover, such as is standard equipment in the conventional steam ager. In operation, the air is driven out of the chamber by blowing in steam, after which a continuous supply of steam provides a steam atmosphere devoid of air. Suitable means are provided to evacuate the condensate.

After being washed with hot water, the goods pass into the neutralizing tank. This is a conventional-type open-width washer, the idler rolls of which are contained in a water-sealed chamber. Carbonic acid gas is bubbled into the water, the excess being captured in the upper part of the chamber, and this also has its effect on the neutralization of the caustic soda in the cloth.

Following neutralization, the goods are washed with hot or cold water, and entered into the bleaching tank of similar construction to those shown for caustic impregnation, and from this machine pass into a smaller festoon steamer, also effectively water-sealed at each end, following which are three washers all of the same type as the impregnators.

From here the cloth proceeds to any suitable form of open-width drying apparatus and so to the finishing.

Each unit of the range is furnished with means for synchronizing it with every other unit by means of compensators connected with speed-control devices. These are not shown in the sketch.

## CONCLUSION

The advantages of this process may be summarized as follows:

1) The goods are desized continuously, not intermittently.
2) The application of steam to the caustic-impregnated goods is likely to be more uniform than in existing methods; in the J box steamer the steam is blown into the mass of goods, at least in one system, and it does look as if this could hardly be uniform.
3) The goods are steamed *without access of air*, thus avoiding the danger of formation of oxycellulose.
4) The use of $CO_2$ in place of sulfuric acid for neutralizing should make it possible to avoid formation of hydrocellulose.
5) The byproduct from this method of neutralization, sodium carbonate, has a valuable use in the dyehouse.
6) More uniform application of steam in the peroxide bleach.
7) It should be possible to run lightweight goods two-ply, three-ply and even more.
8) Open width handling at all times. This should eliminate break-marks, chafe-marks, distortion of fabric, etc.


## ACKNOWLEDGMENTS

Thanks are due to the following:

Royce Chemical Company for time granted the writer to carry out the experiments in an outside laboratory, also for providing all the necessary chemicals except $CO_2$.

Standard Bleachery and Printing Company of Carlton Hill, New Jersey for furnishing the desized fabric on which the experiments were made.

Proctor & Schwartz of Philadelphia for the use of their laboratory and for the invaluable assistance of Jack Scott, of that organization.

A O Hurxthal, who was then vice president of Proctor & Schwartz, for many helpful suggestions and for having some of the drawings made that illustrate this article.

Ralph B Smith, director of the Department of Chemical Engineering of the New Jersey Laundry and Cleaning Institute, for making all the color measurements on the bleached samples, on the Hunter Reflectometer.

Pure Carbonic Inc for supplying the carbonic acid used in this work.

Carl H Brubaker for counsel and advice from his lifetime of experience in the bleaching industry.


## REFERENCES


(1) Ariente, P J, *Textile World* 95, 94-6, July, 1945.

(2) "Commercial Cotton-Bleaching Processes and Their Effects on Fabrics", *Tech Bull USDA* No. 941, Southern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, United States Department of Agriculture.


# Abstracts

### The Influence of Man-Made Fibers on Wool

Johnson, A, Textile Mfg **81**, 229-33, 358-61, 476-81, 514-17, 620-3, (1955); **82**, 71-7 (1956)

IN this long article, running through six issues of the magazine, the author reviews the progress that has been made by the man-made fibers (rayon, acetate, nylon, Dacron, Orlon, Acrilan, Saran, Vicara, etc) in invading the field formerly occupied exclusively by wool. He cites as examples the black wool hosiery once worn by women which was ousted, first by rayon and then by nylon, and the fine worsted linings for suitings which have been replaced by rayon.

The author gives statistics showing the gradual increase in the use of rayon and synthetic fibers over the last 50 years, until in 1952 they contributed 18 percent of the world's production of textile fibers, while wool's share was only 11 percent. He cautions, however, that this does not imply that the gains of the man-made fibers were all at the expense of wool.

He goes into much detail in describing the advantages and disadvantages of the various synthetic fibers when used as partial replacement of wool in blends.

He discusses the economics of wool production, particularly in Australia, and notes a gradual decline in recent years in the merino flocks, which furnish the type of wool needed to spin fine counts.

Among the numerous advantages claimed for wool are its elasticity, moisture regain, less liability to damage by heat and less tendency to pill. On the other hand, some of the synthetics have greater tensile strength, resistance to abrasion, dimensional stability and resistance to chemical treatment. He comments: "When fibers are mixed and combined in a fabric, it is wrong to attribute all the virtues to one of the components by describing the other as an adulterant. Actually, each is essential to the other in every case, otherwise they would not be combined."

The author suggests that the invention of the "perfect" synthetic fiber is more likely to affect mediocre synthetics and cotton than wool. His conclusion is as follows:

"Wool has a wide scope, not because it is sensational in any one feature, but because it is sound in many, and unless our physiological reaction to what we now consider comfortable undergoes a significant change, wool even in its present form is likely to be acceptable for many years to come. In mixtures, each class of fibers contributes its quota of desirable features to a cloth into

which it is made. No single fiber can be expected to fill all textile needs, so there is little doubt that wool will continue to be essential to the success of synthetic fibers."

In closing, he warns that the large land areas on which sheep are raised, and which have no alternative use at present, may become occupied for other purposes in future, and in such case "the fate of wool is sealed."

Ninety-four references to the literature are cited.—WHC

## A Theory of Flame-Retardant Finishes

Gottlieb, I. M., *Textile Research J.* **26**, 156-67, February, 1956.

Many empirical theories have been advanced to explain how a cellulosic substrate is made flame-retardant. Three physical and two chemical theories are described by the author.

**1) Certain flame retardants are decomposed by heat to form a glass-like coating on the individual fibers, serving as a barrier between the cellulose and the oxygen of the air, and trapping the highly flammable tars of decomposition.**

**2) Some flame retardants function by evolving large quantities of a relatively nonflammable inert gas.**

**3) The retardant may absorb large quantities of heat, owing to physical changes in its internal structure.**

**4) Certain inorganic sulfates, phosphates and sulfamates have high hydrogen-bonding activity, at flame temperatures, which enables them to increase the average size of the fragments formed during thermal decomposition and thereby increase the amount of solid char residue.**

**5) It is suggested that flame retardancy is caused by the catalytic dehydration of cellulose through the reaction of the retardant with the cellulose via a carbonium ion mechanism.**

A survey of the newer flame retardants suggests a simple theory for their constitution. The molecule should be water-insoluble to achieve durability in laundering. A solvent-soluble organic molecule is therefore proposed. The ortho-phosphate group should be present in the molecule to dehydrate catalytically the cellulose substrate. The molecule should contain polymerizable groups (eg, resins) to effect a permanency of finish. It should contain halogen or other groupings to reduce the flammability of the gases of decomposition. The necessity to reduce this flammability is shown in anomalous results obtained with the Vertical-Bunsen test method. This is one of the failures of several treatments.

The author discusses at some length the action of organic phosphorus compounds (eg, THPC) as flame retardants. He also describes the evaluation by the Underwriters' Laboratory of an experimental flameproofed shelter developed by the Quartermaster Research and Development Command for arctic use.

The influence of other factors, such as fabric weight and finish, is also discussed.

This paper is based on a segment of the over-all research program initiated by the Quartermaster Corps in the field of flame and thermal protection. Eighteen references to the literature are cited.—WHC

## High Temperature Dyeing of Wool

Lemin, D. R., *Dyer* **115**, 31-4, January 6, 1956.

Package dyeing is increasing in importance in the dyeing industry, and it is in this form that most high-temperature dyeing is carried out.

Regarding the stability of wool dyes to dyeing at elevated temperatures, it is well known that certain dyes may be decomposed, but the author states that the majority of wool dyes have been found to be stable to treatment for one hour at 115°C.

Experiments have been conducted with a number of acid milling and chrome dyes, dyeing at 100, 110, and 120°C, to determine the time required to develop full wet-fastness properties. It was found that at 110°C 15 minutes dyeing time is sufficient, and at 120°C, even less time. It was also found that at these higher temperatures dyes level more rapidly.

Tests were made to determine the effect of high-temperature dyeing on the physical properties of the wool (eg, strength, elastic recovery, etc). At 120°C considerable reduction in both wet and dry strength occurred when either strongly acid or neutral dyebaths were used. The abrasion resistance and the dry extensibility of the yarn were also reduced.

High-temperature dyeing, however, appears to be a practical proposition, provided that certain precautions are taken. The use of strongly acid or neutral dyebaths should be avoided, the preferred limits of pH being between 3 and 6.5. The maximum temperature recommended is 110°C, and the time of dyeing at this temperature should not exceed one hour. Under these conditions there is no appreciable fiber degradation, according to the author. The saving in time of dyeing, as compared with conventional methods, is considerable.—WHC

## Effect of Laundering on Shirts

Grimes, M. A. and Werman, C. A., *Textile Research J.* **26**, 112-13, February, 1956.

After the publication of two previous reports on the effect of laundering on shirts, it was asked whether or not the commercial laundry included in these reports was representative of commercial laundries. To answer this question, sets of the same shirts were laundered in two other commercial laundries. The present report includes a summary of the results of laundering by the three commercial laundries and by two household methods.

The same source of water was used in all methods. The three commercial laundries used essentially the same method, which was said to be that commonly used by commercial laundries. The wash cycle was the same for the three laundries.

The household method included washing in water of 158 ± 2°F with a low-sudsing built detergent in an automatic washer run the full cycle, drying for 20 min in an electric dryer, and ironing with an electric hand iron or a rotary ironer.

The commercial laundries used bleach, starch and bluing, which were not used in the home laundry.

The shirts were examined after 15, 25, and 68 launderings for damage. The report describes the progressive signs of wear in the commercially laundered shirts, including worn collarbands, torn buttonholes, broken buttons, and ripped seams, compared with only slight damage to the household-laundered shirts.

The strength loss of the fabric after 68 commercial launderings was from 20 to 30 percent; the household-laundered shirts actually gained slightly in strength in some cases. Viscosity measurements by the cupriethylenediamine method gave a much reduced viscosity for the commercially laundered shirts.

Shrinkage of the shirts (all of which had been Sanforized) laundered commercially averaged about 3.6 percent, compared with 1.75 percent for the household launderings.—WHC

## The Causes of Anomalous Results in Light Fastness Tests

McLaren, K., *Dyer* **115**, 35, January 6, 1956.

Providing deleterious gases, such as sulfur dioxide and possibly ammonia, are excluded as a possible source of anomaly, the only factors which are known to influence the rate of fading of dyed samples compared with standards are differences in 1) the nature

(*concluded on page 309*)

# Proceedings of the American Association of Textile Chemists and Colorists

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MAY 7, 1956

## Activities of the Local Sections

### Southeastern

Ralph Champion, Pepperell Mfg Co, and Francis Nerney, Becco Chemical Div, received the plaudits of the Southeastern Section for a fine meeting on April 14th at Lindale, Ga.

Featured speaker at the technical session was P J Fynn, J C Penney Co, who spoke on "Operation Cue," discussing the effects of an atom-bomb blast on various textiles.

G H Smith, general manager, and R J McCamy, assistant general manager of Pepperell Mfg Co, Lindale, Ga, and W E Crooks, plant manager, Celanese Corp of America, Rome, Ga, extended to members and guests the privilege of tours of their plants. Both tours were well attended.

Dinner was served at the Lindale Legion Club House.

### Philadelphia

The November 2nd meeting of the Philadelphia Section, originally scheduled for the Sylvania Hotel, will be held instead at the Drake Hotel, 1512 Spruce Street, Philadelphia.

## AATCC Calendar

COUNCIL

June 15 (New York); week of Sept 10th (New York, N Y); Nov 16; Jan 18, 1957

NATIONAL CONVENTIONS

Sept 13-15, 1956 (Waldorf-Astoria, New York) (as part of the Perkin Centennial, Sept 10-15); 1957 (Boston); 1958 (Hotel Conrad Hilton, Chicago); 1959 (Washington, D C); 1960 (Philadelphia, Pa)

HUDSON-MOHAWK SECTION

May 18 (Ladies' Nite); June 22 (Annual Outing)

MID-WEST SECTION

June 16 (Outing—Browns Lake Resort, Burlington, Wis)

NEW YORK SECTION

May 18 (Kohler's Swiss Chalet, Rochelle Park, N J)

NORTHERN NEW ENGLAND SECTION

Sept 28 (Annual Outing—Wachusett Country Club, West Boylston, Mass); Oct 19 (Science Park, Boston, Mass); Dec 1 (Annual Meeting—Hotel Vendome, Boston)

PHILADELPHIA SECTION

May 25 (Annual Outing—Huntingdon Valley Country Club, Abington, Pa); Sept 28 (Abraham Lincoln Hotel, Reading, Pa); Nov 2 (Drake Hotel, Philadelphia, Pa); Dec 7 (Kugler's Restaurant, Philadelphia, Pa)

PIEDMONT SECTION

June 8-9 (Outing—Mayview Manor, Blowing Rock, N C); Oct 6 (Annual Meeting—Hotel Charlotte, Charlotte, N C)

RHODE ISLAND SECTION

May 25 (Ladies Night, Sheraton-Biltmore Hotel); June 15 (Annual Outing, Pawtucket Country Club); Oct 18 (Johnson's Hummocks Grille); Dec 6 (Annual Meeting, Johnson's Hummocks Grille)

SOUTH CENTRAL SECTION

June 22-23 (Lookout Mountain Hotel, Chattanooga, Tenn); Dec 1 (Hotel Patten, Chattanooga, Tenn)

SOUTHEASTERN SECTION

June 8-9 (Outing—Radium Springs, Albany, Ga); Sept 22 (Columbus, Ga); Dec 8 (Atlanta, Ga)

WESTERN NEW ENGLAND SECTION

June 15 (Outing); Oct 15 (Annual Meeting—Hartford, Conn); Nov 16 (Rapp's Restaurant, Shelton, Conn)

## Employment Register

*This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the secretary of the Association, Post Office Box 28, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the secretary.*

56-3

*Education:* BS, Textile Chemistry.

*Experience:* Dyer, printer, assistant superintendent.

*Age:* 29; married; references; position as textile chemist, development work desired, preferably in South or West. 4-23, 5-7

56-4

*Education:* Dyeing and finishing graduate.

*Experience:* Chemist, supervision, technical service. Work simplification, correspondence, etc.

*Age:* 38; married; references; desires position in sales, production or laboratory. Prefers Mid Atlantic or New England. 5-7, 5-21

## Membership Applications

April 6, 1956

SENIOR

**Emil Baer**—Sales mgr & corp secy, Apex Chemical Co, New York, N Y. Sponsors: M L Hurwitz, E Berlinger.

**William E Baldwin**—Assistant plant chemist, Fairforest Fin Plant, Spartanburg, S C. Sponsors: W E Rixon, L C Greene.

**Graham Barker**—Tech Repr, Emulson Chemical Corp, Chicago, Ill. Sponsors: C R Trommer, F H Buck, Jr.

**Roscoe J Breazeale**—Tech sales repr, Warwick Chem Co Div, Sun Chem Corp, Rock Hill, S C. Sponsors: E A Murray, J L Lindsay, Jr.

**Tom S Brooks**—Dyer, Russell Hosiery Mills Inc, Star, N C. Sponsors: K A Bridges, W B Huntley.

**John J Fantry**—Suntone serv mgr, Warwick Chem Co Div, Sun Chemical Corp, Rock Hill, S C. Sponsors: R G Perriello, S H W Nye.

**Frank Masterson**—Chemist, Monsanto Chemical Co, Charlotte, N C. Sponsors: S F Sylvester, J W Stewart.

**Wallace B Newman**—Salesman, E I duPont de Nemours & Co, Inc, Orchem Dept, Charlotte, N C. Sponsors: H H Field, R D Sloan.

**Charles H Southwick**—Supt, dyeing & vice pres, Model Dye Southern Corp, Sumter, S C. Sponsors: S L Hayes, E T Mobley.

# AATCC NEWSLETTER...

MAY 7, 1956

RESEARSH NEWS IN GENERAL:

AATCC's Executive Committee on Research has cautioned organizations outside the Association against using any AATCC standard test methods in modified form. In a resolution passed by ECR at its recent meeting April 19 in Philadelphia, ECR passed the following resolution:

"The Executive Committee on Research of the American Association of Textile Chemists and Colorists, taking cognizance of the fact that some organizations performing fastness tests on textiles using test methods designated as being standard AATCC test methods, actually do not conform with AATCC recommended procedures, goes on record as stating that such different or modified methods should not be referred to as AATCC procedures, and requests that such references be omitted."

At this April 19 meeting, ECR also approved the new Blue Standards as duplicating the old Blue Standards. Frank Rizzo was congratulated for the excellent work he has done for the last three years in preparing the new standards. Those in dire need of these new Blue Standards may obtain one yard cuts in full width of the cloth, subject to future billing when the price is determined, by writing to Dr Stiegler at Lowell. . . . ECR also enthusiastically received a report from a special task group headed by Charles Schmitt, which indicates that the use of Langley units in conjunction with Blue Standards might solve problems arising from the use of hours, sun hours or ultraviolet sun hours as a yardstick in sunlight testing on fabrics. . . . Mr Schmitt told ECR further studies are continuing and a more complete progress report will be published shortly in the American Dyestuff Reporter. . . . Edmund A Leonard reported to ECR on the work of the National Research Advisory Committee, which has handled and tabulated some 71 research suggestions. Recommendations of this Committee to ECR were tabled for further study.

AT RESEARCH HEADQUARTERS IN LOWELL:

Recent visitors to AATCC labs in Lowell included Kwon Hei Yoon, managing director of Kyung-Puk Textile Association, Taegu, Korea, who is studying in this country at PTI. During his visit to Lowell, he took out an AATCC membership. . . . Sam Illingworth, of the U S Rubber Co, Passaic, N J, spent some time with Dr Stiegler discussing the Accelerotor. U S Rubber has just purchased one of the instruments and is interested in correlation of Accelerotor results with end use on heavier types of textiles. . . . Sidney M Edelstein, president and technical Director of Dexter Chemical Corp and chairman of the Association's new National Archives Committee, came to Lowell to discuss with Dr Stiegler and Dr Chapin sources of material for this committee. . . . Also visiting recently: Robert C Allison, of Geigy Co, New York; P C Mehta, assistant director, The Ahmedabad Textile Industry's Research Association, Ahmedabad, India, and Werner Klaas, in connection with his work on Light Fastness Standards. . . . Also, members of the Dimensional Change Committee (H C Donaldson, chairman; E Artim, secretary; K H Barnard, H R Bellinson, R B Smith, and G S Wham, Jr) met with Research Associate G M Kidder to discuss and formulate plans for a full-scale program to study the possibilities of formulating a Dimensional Restorability Test Method. . . . Lowell is collaborating in a preliminary study by the recently-reactivated Crocking Committee to determine reproducibility in day-to-day testing, and is doing additional work to determine the possibility of revising the drycleaning procedure of the Flammability Test.

COMMITTEE NEWS:

ECR has established a new committee to set up a test method on fulling agents . . . has reactivated the Committee on Colorfastness to Pleating . . . also has established a Reference Committee on Test Methods . . . has dropped the Reference Committee on Aging of Textiles (because this work is considered in the scope of the new Committee on Weathering . . . and has established a Reference Committee to study the place and use of radioactive elements in AATCC test methods. . . . Technical Committee on Research approved a number of committee reports at its last meeting, in Philadelphia April 20, and approved the establishment of former Tentative Test Method 9A-54 (Colorfastness to Stoving) as a Standard Test Method, replacing TM 9-52. The committee was then placed on a reference basis.

# Perkin Centennial Notes

TODAY it is difficult to realize the significance of the discovery of the first synthetic dye, by William Henry Perkin, 100 years ago. We have come to expect the availability of all types of dyes developed for specific applications, and the countless variety of all kinds of colored articles and merchandise that are within our reach bears this out.

In turning back the pages of history, prior to 1856 the story was quite different. The early efforts of man to duplicate the beauty and color of his surroundings was attempted by staining his clothes with colored juices derived from flowers, fruits, bark of trees, insects and shellfish. Most of the resultant dyeings were only temporary because so few true dyes existed in Nature, the variety of shades was limited and generally did not stand up to the effects of sunlight and washing.

However, there were some colors that have survived the ravages of time. Indigo was one, and the renowned Tyrian Purple another. A garment dyed with indigo was found in the ancient Egyptian city of Thebes, in a tomb reputed to be 3000 years old, the color having been derived from the leaves of the indigo plant. The "purple of Tyre," famed for its beauty and durability, was obtained from different varieties of shellfish and expertly manufactured by the Tyrians. However, dyed fabrics were a luxury and could only be afforded by royalty and the wealthy as connoted by the names "royal purple," "royal scarlet" and "royal blue." Pliny condemned the high prices charged by dyers for Tyrian purple. A pound of it cost the equivalent of what would now be $150.00, which presents a striking difference when compared with the present-day figure of $1.17 per pound reported by the U S Tariff Commission for the average price of all dyes produced.

The continued desire of individuals to maintain beauty of surroundings through more durable colors led to the use of mordants which possessed the ability of causing the dye to adhere firmly to the fabric. Not until this discovery was made, probably in India prior to 2000 B C, did the art of dyeing make any appreciable progress. Through this mordanting technique the Egyptians were able to use the Biblical scarlet, the last of the "big three" dyes of that early period, which was obtained from the insect, kermes. The color was so highly regarded that it was reserved primarily for royalty and the military and was used in the military cloaks of the Greeks and of the Roman Emperors.

Yellows were produced by the Egyptians from saffron, derived from the flowers of the common yellow crocus. Reds were developed from the roots of the madder plant, which was also used to produce purples and browns. The brilliant and durable scarlet, "Turkey Red," was probably known before the Middle Ages; it was developed in the Near East and later adopted by the Europeans. The dyeing process required for applying Turkey Red is one of the oldest known and also the longest, and it is believed by some historians that the scarlet thread mentioned in the 38th chapter of Genesis was dyed in this manner.

The skills of the dyers in Egypt, India, China and Persia were brought into Europe by the Phoenicians and Alexandrians, but little technical progress was made on the continent until the 13th century because most of the dyeing was done in the home. At that time, the accomplishments of Federigo in Italy stimulated a considerable revival in the art. The first book on dyeing was published in Italy in 1429, and from there knowledge spread to Germany and the rest of Europe, centering especially in Holland and Belgium. The discovery of the New World and the opening of the Cape route to the East brought in coloring materials and dyeing methods. Cochineal, similar to kermes, was imported from Mexico early in the 16th century by the Spaniards who had seen the natives employing these insects for dyeing.

But as long as man was dependent upon the animal and vegetable worlds for his dyes, his progress was restricted by the skill of the operator in mixing dyes and perfecting techniques. Dyeing was then an art, not a science as it is today. The dyes available varied greatly in quality and, consequently, so did the results obtained. Many of the natural dyes lacked fastness and were difficult to apply satisfactorily to fabrics and they were also expensive. There is little evidence to support the idea which has been so firmly fixed in the minds of many, that to obtain durable and artistic effects it was necessary to resort to the vegetable dyes of our ancestors. Dyeing is now based on soundly established chemical principles, the end results can be predetermined, the fastness is known and the correct dyes can be selected to conform with the requirements of the finished fabric, garment or article.

Little fundamental progress was made in producing better dyes until the accidental discovery of mauve in 1856. William Henry Perkin was attempting to synthesize quinine, using aniline as one of his raw materials. In one of his unsuccessful experiments a dark-colored mass was formed, but when it was dissolved in alcohol a violet liquid resulted which had the power to dye silk and wool. Had it not been for the presence of toluidine as an impurity, the development of the first synthetic dye might not have occurred at that particular time. Perkin had the foresight to recognize the industrial possibilities of his invention and, after patenting the process, established the first factory in the world for the manufacture of dyes.

Compared to some of the present day processes for vat and other type dyes, Perkin's method of manufacturing mauve was quite simple, consisting of only four steps; but the yield of actual dye was only five pounds per ton of coal and in 1860 the price of aniline violet in the United States was around $300.00 per pound.

The publication of Perkin's discovery activated interest in the study of the chemical composition of coal tar products by chemists all over the world. During the following fifty years, many important discoveries followed one another in rapid succession. It was found that of the ancient dyes, indigo and turkey red could be produced synthetically and more economically than the natural products. Despite intensive activity on the part of chemists the time element between the development of new dyes in the laboratory to practical commercial production usually was a matter of years. By 1890, synthetic dyes had attained considerable stature and natural dyes were well on their way to obscurity.

European chemical manufacturers had established a virtual monopoly of the dye industry and prior to 1914 only 10% of the dyes consumed in the United States were made here. In that year the domestic production was less than seven million pounds. It did not represent complete preparation of the dyes, but merely combining certain

(*concluded on page P308*)

*1955 Intersectional Contest——3rd Prize Winner——*

# IMPROVEMENT OF CROCK FASTNESS IN NAPHTHOL-DYED FABRICS*

## PIEDMONT SECTION

Although naphthol dyes have long been prized for their brilliance of shade, high tinctorial value, and economy of application, these colors have one weakness which has been an almost constant source of trouble to the practical dyer—lack of fastness to crocking. That this problem has been recognized for a long time is attested by the copious literature concerning ways and means of alleviating crocking in naphthol dyeings, but up to now no certain solution to the difficulty has been found. With the increasing commercial importance of dyes of this class, research on methods for the improvement of crock fastness seemed a particularly appropriate subject for study by members of the Piedmont Section of the AATCC. The attack on this problem from several different angles over 18 months is the subject of the present paper.

The originality in this paper lies in the fact that two other Intersectional Contest Papers on this subject concluded that further research was needed to resolve the controversial factors influencing crocking.

Studies have been made of the effects of a number of variables in the naphthol-dyeing process, among them the following:

1) Coupling pH
2) Coupling temperature
3) Rinsing before coupling
4) Steaming before coupling
5) Soaping methods
6) Addition of alcohol to the coupling bath
7) Crocking behavior of various dyeing combinations
8) Effect of finishes applied after naphthol dyeing.

The research reported herein shows there is no simple remedy for the problem of crocking, but several contributory causes, not previously investigated, have been defined. Certain variables which do not appreciably influence crocking have also been found. The mill application of these research results, in selection of proper naphthol combinations, dyeing procedures, and use of correct amounts of chemicals, such as caustic soda for dissolving naphthols, will do much to minimize crocking complaints. This paper also will be of both practical and scientific value because of the new information developed about the effect of certain finishing treatments, such as the use of colloidal silica, water repellents and softeners.

These results have led to the following conclusions:

1) Interlaboratory tests show no pronounced effect of coupling pH over the range of 3 to 6 on crocking characteristics. Coupling outside the range of 3.5-5.0 may affect the shade, however.

2) Coupling after drying gives better crock fastness, and heavier, more uniform shades than coupling in the wet state; coupling at a pH of 4.5 appears to be optimum.

3) Crocking is not affected by coupling temperature over the range of 32-120°F. Shade and fastness properties of selected naphthol-base combinations were good when coupling was carried out in a fresh bath, even at temperatures as high as 120°F. Because coupling bath stability is markedly lower at the higher temperatures, the shade of dyeings is adversely affected by increasing temperature and age.

4) Steaming prior to coupling improves crock fastness slightly.

5) Temperature of rinsing bath before soaping does not affect crocking, but causes tarring if too hot.

6) Mechanical removal of loosely-held surface particles by brushing improves crock fastness.

7) Scouring with alkali-soap mixtures at higher temperatures to improve crocking is better for soaping naphthols than synthetic detergents or plain water. Wash fastness and brightness of shade is also improved by the alkaline soap, but not by acidified synthetic detergent scouring.

8) Isopropyl alcohol, which has been recommended for the stabilization of coupling baths, does not noticeably affect crocking. A slightly heavier shade is produced in a bath containing alcohol.

9) A critical investigation of various naphthol-developer combinations, with coupling pH held constant, showed marked differences in crock fastness and need for proper selection of combinations.

10) Among a considerable number of chemical finishing agents studied, including resins, softeners, water repellents, and finishing oils, only a few were found which did not reduce dry crock fastness. A silicone water repellent had no measurable influence on crock fastness, while the greatest reduction was found in samples treated with a 2 percent dispersion of colloidal silica. Other water repellents and fatty softeners adversely affected dry crock. The effect of finishing agents on wet crocking was much less pronounced.

COMMITTEE

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## I INTRODUCTION

NAPHTHOL colors offer the present-day dyer the promise of a wide range of shades in brilliant, bright tones, which are fast to light and washing. With naphthol dyes, brilliant red, wine and scarlet colors are possible that can be obtained with no other dye. They may be applied on almost any type of dyeing equipment. The economy of the naphthol dye is another important factor in its use. The use of naphthol colors on the newer synthetic fabrics, particularly nylon, acetate, and Dacron, has increased their importance. It has been pointed out that naphthol colors have been used instead of vats to avoid tendering of the fabric on exposure to weathering in Army duck (*1*).

Naphthol colors, with their great eye appeal and superior wash fastness, have, however, the serious fault of crocking. This has been the perennial bane of the colorist for many years, yet the problem is still to be solved. Here is a dye with so many pleasing properties and numerous advantages, but its one defect seriously limits its use.

*Crocking* is the transfer of color from dyed textile materials to other surfaces by rubbing. This term, like many others in the textile industry, has an odd etymological history which reflects the early efforts of dyers. Crocking was apparently first used to describe this defect because of its similarity to the smudge created when soot-blackened crocks or vessels were rubbed on fabric. It has not been clearly stated in previous literature, but the authors of this paper feel it is desirable to differentiate between crocking, which is a color transfer, and rubbing fastness, which refers to a color change of the original fabric.

Crocking results from the surface precipitation of small particles of dyestuff that adhere poorly to textile fabrics and thus have low resistance to rubbing. The imposing array of literature and research available on the subject of naphthol dyeing might indicate no need for additional study on this problem. However, the dyer or printer is faced almost every day with the problem of obtaining improved fastness to crocking in naphthol colors, and therefore it is obvious that additional work is needed to prevent customer complaints.

Since the problem of crocking with naphthol colors, particularly in the red, wine, and scarlet shades is still a prevalent complaint, it is the object of this study to review those factors believed to cause crocking, to conduct additional experiments to clarify controversial issues, and to determine, if possible, the best methods for dyeing with naphthol colors to prevent crocking.

## II PREVIOUS WORK

A) PRINCIPLES OF NAPHTHOL DYEING———Naphthol dyes, also known as insoluble azo dyes, are formed in the fabric, yarn or fiber being dyed. There are four basic steps

* Presented by R Hobart Souther on September 24th in the Viking Room, Haddon Hall Hotel, Atlantic City, N J. Revised ms submitted 1/27/56.

in the production of naphthol colors: impregnation with a phenol (β-naphthol or derivative); intermediate treatment, such as drying, rinsing, salting, steaming; development by means of a diazo compound, which couples readily with naphthol or phenol bodies to give insoluble colored precipitates; and aftertreatment to remove excess dyestuff and auxiliary chemicals.

The phenol or naphthol compounds may be classified in three groups depending upon their rate of exhaustion and affinity for the fiber; 1) the substantive dyes, which exhaust rapidly with an exhaustion of from 40-98%; 2) the nonsubstantive dyes, which do not exhaust readily, with an exhaustion of not more than about 25%; and 3) an intermediate group. The substantive class, such as Naphthol AS-SW, AS-LC, AS-LB, AS-DB, AS-GR, AS-SG, and AS-LG, is very important for goods demanding a high degree of fastness and is particularly suitable for application in equipment that permits salt rinsing after naphtholating and before coupling, and is valuable where drying before coupling cannot be carried out. The nonsubstantive class, such as Naphthol AS, AS-MX, AS-D, AS-OL, AS-PH, AS-RL, AS-BG, AS-BS, AS-BO, AS-E, AS-G, and AS-LT, does not have much affinity for the fiber and must be applied continuously for complete utilization of the dyestuff to attain the economy characteristics of the naphthols. The intermediate group, such as Naphthol AS-TR and AS-ITR, does not exhaust very well but stays on the fiber well enough to permit salt rinsing for application by batch methods.

The diazo compounds originally used for development of the naphthol compound on the fiber were the fast color bases, which require proper diazotization into a satisfactory coupling agent for the naphtholated goods. More recently fast color salts have been placed on the market, which give the dyer a wide variety of combinations of naphthol and bases or salts from which to choose.

Since the dyestuff is actually produced by the dyer or printer, he is faced with problems that are normally the concern of the dyestuff manufacturer, such as obtaining the highest possible color yield with the maximum fastness qualities.

B) FACTORS BELIEVED TO CAUSE CROCKING AND RECOMMENDATIONS BY OTHERS FOR IMPROVEMENT OF CROCKING ——It is generally conceded that crocking with naphthol colors is caused by loosely fixed dyestuff on the surface of the fabric. Why this dyestuff is loosely fixed and methods for attaching the dye more firmly are not a matter of universal agreement. Wuterich states that all operations in the production of a naphthol dyeing influence the fastness to crocking (*2*). Different authors have claimed varying degrees of importance for the many individual factors.

*1) Fabric Construction and Preparation.* It has been proposed that fabric construction and preparation affect the crock fastness of naphthol-dyed goods. Blackshaw (*3*) has shown that the relative crock fastness of two cloths dyed in the same manner with azoic colors is affected by the physical construction of the fabric and the nature of the surface. It has been suggested that naphthol-dyed cottons are aided by effective cleansing of the fabric before dyeing (*4*). Fitzgerald (*5*) found that goods made of warp-mercerized yarns can be dyed satisfactorily by a naphthol pad-jig method without drying after naphtholation if substantive naphthols are used; otherwise it is more practical to dye the goods on continuous operation.

The New York Section 1954 Intersectional Contest Committee (*6*) concluded that crocking is diminished by processes which tend to give better penetration of the dye into the fiber, such as better preparation of the material before dyeing, but the data also showed very little difference in wet or dry crock ratings on naphthol-dyed fabrics which had been boiled off only, boiled off and bleached, or boiled off, bleached and mercerized.

Celantano (*7*) states that, for jig dyeing, the material should be scoured with a synthetic detergent and soda ash over two ends to give it the required absorbency; then the scouring liquor is dropped and the material is given a warm rinse. If the material that is to be jig-dyed has been previously scoured, impregnated with rewetting agent and dried, it is then possible to enter the cloth dry. It is claimed that this procedure of using dry cloth containing a wetting agent for naphthol impregnation in a jig not only eliminates the two ends usually required to wet out the material, but gives better crock fastness in the final dyeing.

Absorption and construction of the goods may determine choice of substantive or nonsubstantive dyes. Williams (*8*) states that light constructions of print cloths, such as 60x48 and 64x60 unmercerized, are very hard to dry with nonsubstantive naphthols without showing some signs of color migration. By mercerizing these same fabrics, which helps hold the color in the goods, these constructions can be dried without difficulty. The more absorbent the material and the more evenly it is woven, the less trouble is experienced from colors that are hard to dry.

*2) Impregnation.* The impregnating liquor or naphthol solution as well as the method of impregnating the goods have been shown to affect the crock fastness of naphthol-dyed goods. Lindsay (*9*) states that impregnating the material consists of saturating it on some type of dyeing equipment with a solution of the necessary naphthols. These products are not soluble in water, and must be brought into solution with caustic soda to form a naphtholate, with the following reaction:

$$\text{naphthol} + \text{caustic soda} \rightarrow \text{naphtholate} + \text{water}$$

The two methods for dissolving the naphthols are:

**_Hot Method_: Dry naphthol is carefully pasted with a wetting agent, and the caustic is poured in together with sufficient hot water for dissolving. The mixture is heated (boiled if necessary) until a clear solution is formed.**

**_Cold Method_: Alcohol or other expensive dispersing agent is used to paste the naphthol, and the caustic, dissolved in a small quantity of water, is poured in slowly to prevent the loss of alcohol. Solution is practically immediately obtained without heating.**

The concentrated solution first obtained should be diluted, at the temperature of the impregnating bath, with water containing caustic and in some cases a good dispersing and wetting agent.

The 1949 South Central Section Intersectional Contest Committee (*10*) studied the factors influencing the crock fastness of package-dyed naphthol cotton yarns, and stated that too much importance cannot be attached to proper naphtholation, since the best conditions applicable after this operation will not clear up crocking caused by an improper procedure here. In comparing the cold method of preparing the naphthol solution with the hot method, their results showed lower color value by the hot method and crocking of the yarn was just as great, if not greater. They found that quite frequently some of the naphthol pre-

cipitated when poured into the dyebath and this condition was considerably alleviated when the alcohol content was increased. It was also found that a solution of greater stability is obtained if an equal weight of 33% caustic solution is added to the Naphthol AS-SW (stock naphthol used in these experiments) instead of an equal weight of 25% caustic soda. They recommended that it would be good practice to filter all naphthol solutions through a fine cloth just as they are being added to the dyebath.

Nuttall (*11*) suggested three methods for applying naphthol colors to piece goods:

1) **naphtholating and coupling on the jig**
2) **naphtholating on the pad, batching up on rolls wet, salting and coupling on the jig**
3) **naphtholating on the pad, dyeing and coupling on the pad with continuous washing (when using nonsubstantive naphthols).**

He recommended that the third method is quick, gives good production, and is by far the best method for penetration, as well as for crocking and bleeding.

Wuterich (*2*) stated that all of the naphthol in solution will not usually be absorbed, but after a certain time (about half an hour) an equilibrium will be established between the naphtholate remaining in the solution and that combined with the fiber. This equilibrium is referred to as the affinity or substantivity. When the material is taken out of the impregnating bath it not only contains the quantity of naphthol which has been absorbed, but also a quantity of naphthol held mechanically. In the subsequent developing bath the dyestuff will not only be produced by the fixed naphthol, but also by the quantity of naphthol which has been carried along mechanically by the goods. The dyestuff formed by the latter will not combine with the fiber but will be present in between the fibers and will impair the fastness to crocking unless it is removed. He summarizes the precautions which have to be taken in impregnating in order to obtain a satisfactory fastness to crocking—provided that the naphthol solutions have been prepared correctly:

1) **hydroextract the goods as thoroughly as possible after impregnating or carry out an intermediate rinse**
2) **impregnate the goods with substantive naphthols or in case of naphthols of lower substantivity, carry out the impregnating in presence of a salt solution**
3) **carry out an intermediate drying (possible only in the case of piece goods).**

Williams (*8*) and Stone (*11*) stress the importance of a properly designed pad. It is suggested that, with proper equipment, naphthol combinations that vary largely in degree of exhaustion can be run together with a minimum of trouble. The pad should be designed so that material can be run straight through the nip or immersed under a small roll when necessary. Large squeeze rolls appear better because it is easier to maintain a proper set, and better squeeze effects are produced, thus eliminating the possibility of bowing the rolls, which may bring about dyeing of heavy centers on heavier fabrics. The proper squeeze effect on the pad governs the efficiency of drying.

Various temperatures for naphtholating have been recommended. Padding at high temperatures around 200° F was found to be very beneficial in keeping heavy concentrations of naphthols in solution (*8*). Another investigator (*7*) stated that, for jig dyeing, although naphtholating is best warm——not over 120° F——at the beginning to ensure better penetration, it should be allowed to cool off during naphtholation, as a naphthol has much better affinity from a cool than a hot bath. It was also found (*10*) that there was a gradual decrease in color value and crock fastness of package-dyed naphthol cotton yarns as the naphtholation temperature increased or decreased from the 110° F optimum. Nuttall (*11*) recommends padding in a two-bowl pad at 180° F. Indian investigators (*13*) found that at higher temperatures the rate of adsorption was greater and at equilibrium the amount of adsorbed dye was greater than at low temperatures. The effect of temperature appeared to be more marked for dyes of high substantivity. Russian scientists (*14*) found the substantivity of the naphthols was decreased by a rise in temperature, with the optimum temperature 122° F-140° F. Still another source (*15*) states that, while the substantivity of naphthols is greatest at about 85° F, for cloth of good absorbency, it is advisable to run at 120° F, in order to give the maximum penetration. For heavy goods, or where the padding process demands some degree of retarding of the substantivity, higher temperatures are used. A few naphthols call for definite temperatures for best results. Creslow (*16*) states that difficulties of penetration, economical use of old dyebaths, and differences in substantivity of different naphthols are claimed to be solved by using hot naphthol baths. Also with hot baths, the amount of naphthol and diazo compound required for a given shade can be estimated. Lindsay (*9*) states that practically all of the naphthols give their highest yields on the fiber at ordinary temperatures, but in practice the bath is usually heated 110 to 120° F to improve penetration and circulation.

Various assistants may be used to stabilize and disperse the naphtholating liquor. Salt has already been mentioned as an additive agent in the naphtholating bath for increasing the exhaustion of the naphthol onto the fiber. However, it has been found (*10*) that the amount of salt required to exhaust the naphthol is much lower than that which is ordinarily used, and a high salt concentration leads to increased crocking. These investigators also found that, in package-dyed naphthol cotton yarns, naphtholation for 1 hour with no salt, or 15% Glauber's salt added, gave dyeings that were more level and of better crock fastness.

Another source (*13*) states that for low concentrations of sodium hydroxide, sodium chloride, sodium sulfate, sodium phosphate, and soap, the amount of dye adsorbed was increased; as the concentration was increased, the adsorption passed through a maximum and then decreased. It was also found that addition of alcohol, gum tragacanth, and agar-agar lowered the amount of dye adsorbed.

Other investigators (*14*) also found that addition of ethyl alcohol, pyridine, gelatine, and glue decreased the selectivity of the naphthols by the cotton in alkaline solution. Salt sharply increased the substantivity while addition of formaldehyde decreased the substantivity of Naphthol AS and AS-RL but increased it for AS-BS. Addition of alizarin oil increased, as a rule, the substantivity of the naphthols in alkaline solutions.

It has been pointed out (*8*) that animal glue has a stabilizing action on naphtholating liquor and aids in keeping down foam, but if too much is used on fabrics that are hard to penetrate, the glue will hold off developing liquors and cause poor penetration. Lime-free glue must be selected, as stability of the pad mix is markedly reduced by lime salts. Sulfonated castor oils are also suggested as an excellent medium for stabilizing mixes, but have the drawback of foaming.

It has been shown by chemical equations and tests (*17*) that formalde-

hyde, in its role as a stabilizing agent in the dyeing of cotton, actually enters the chemical reaction.

With Eunaphtol AS (*8*), a surface-active modified lignin-sulfonate, it has been found possible in most cases, to eliminate glue, penetrants, sulfonated castor oil, and pine oil, and use only the one product.

Forstner and others (*4*) suggest that naphthol-dyed cottons are aided by avoidance of excessive soluble oil or protective colloid in the naphthol bath, and addition of formaldehyde to the naphthol bath.

3) *Intermediate Treatment.* Hydro-extraction of the goods after impregnating, an intermediate rinse, or an intermediate drying already have been suggested as means for improving crocking. In order to test the hypothesis that certain rinses after naphtholation might remove the surface naphthol solutions or solids that cause the formation of a surface lake during the developing reaction, several dyeings (*10*) on package-dyed naphthol cotton yarns were made in which rinses were given after naphtholation with:

1) plain water
2) 25% common salt
3) surface-active detergents
4) 5% alcohol and 0.1% caustic soda.

Results showed that the effect of dyeings number 1 and number 2 was not apparent. There was some loss in color value with number 3 and no apparent increase in crock fastness. The crock fastness obtained with dyeing number 4 was somewhat improved but there was a slight decrease in color value.

In jig dyeing (7), it is recommended that the material be given a salt rinse in fresh, cold, salt solution. For padding of naphthols, if the plant is equipped with a hot flue, it is suggested that the normal procedure would be to pad a nonsubstantive naphthol onto the piece goods and then to dry the naphtholated material.

Vendor (*18*) states that careful removal of moisture after the bottoming bath is important. Excessive centrifuging periods should not be used in place of high-speed centrifuging. In the case of piece goods intermediate drying periods should be used.

4) *Coupling.* The pH of coupling and developing has been the subject of some discussion on the effect of crock fastness. The impregnated fibers contain, in addition to the naphthol, a total quantity of alkali consisting of the dye which has been absorbed by the fiber and the dye which has been carried along mechanically (*2*). In most cases, it is necessary to neutralize the alkali which has been carried along with the material into the developing bath, by the addition of alkali-binding reagents. The reagents coming into consideration are limited to those with which a pH adjustment of about 3 to 7 can be obtained.

Varying the acetic acid concentration in the developing bath showed little, if any, difference in the crock fastness, but affected the shade some (*10*).

A pH of 4.5-5 was recommended (*14*) for the development of Naphthol AS with ∝-naphthylamine, p-nitro-o-toluidine, and dianisidine, whereas a pH close to 7 was recommended for Variamine.

Williams (*8*) stated that control of proper pH is an important factor. When using developers that will stand the use of acetic acid as an alkali-binding medium, this factor can be easily controlled. If it is not feasible to use acetic acid, Eulysine AS (water-soluble complex amine) is recommended.

As already mentioned in discussing the impregnating operation (*2*), when the impregnated goods are treated in the developing bath the dyestuff is formed not only from the naphthol combined with the fiber, but also from that present between the fibers. The insoluble color lake thus formed outside the fiber impairs the fastness to crocking. There is also the color lake formed from the naphthol which has gone back into solution during the coupling process. This resolution, which causes not only an additional formation of color lake in the bath, but also results in the production of weaker shades, can be partly but not completely prevented by the addition of salt to the developing baths. It is also possible, provided cost considerations do not rule it out, to accelerate the coupling by increasing the concentration of the diazo solution. The color lake which does form in the developing bath can be so finely dispersed by addition of a nonionic detergent that it can be removed together with the developing bath or by subsequent rinsing, in which case the addition of a small quantity of dispersing agent to the first rinse bath may be advisable.

It has been suggested (*18*) that the use of Sandozol KB (sulfonated vegetable oil), Diazopon (neutral dispersing agent), or glue in the developing bath prevents completely or partly the mechanical precipitation of the azo dye in the fiber, as these substances keep the dye particles in suspension. The proper diazotization temperature of the bases should be maintained strictly.

Another investigator (*8*) suggests that the developing bath is a most important factor as solutions are not very stable. He recommends the most satisfactory equipment for this purpose is the 3-roll pad, utilizing a dye-bath as small as possible, maintaining a slight overflow to wash off any naphthol precipitates that form on the surface. Refrigeration units should be installed to keep liquors cold at this point. When ice is used, the dyer is faced with the problem of dilution. During summer months when large quantities of ice become necessary with certain bases, the dilution is difficult to control. After leaving the developing pad, sufficient time must be allowed for complete coupling of the developer, which may be accomplished by sky rolls. The number of sky rolls used should be figured to allow sufficient time for the slowest coupling combination.

It was found (*14*) that the loss of azo and diazo compounds can be decreased by 10% if, at the end of the coupling reaction, the material is held in a steam medium for 1-2 minutes at 212° F or is dried in drums. The diazo solution should contain compounds to bind the alkaline materials in the naphtholated fabric. In highly reactive diazo compounds zinc sulfate may be used and for less active, sodium bicarbonate may be used.

The effect of addition of sequestering agents and surface-active detergents to the developing bath was studied (*10*), and no effect was found as to shade or crock fastness with any of the agents tested.

Broun (*19*) places emphasis on the importance of careful control of the diazotization and neutralization of the prepared base solutions as well as careful adjustment of the amount of sodium acetate, acetic acid, and formic acid used in the development bath.

Temperature of the developing process should be approximately 80° F, although some require lower temperatures, since the diazotized amines are unstable and decompose very rapidly at temperatures above 100° F. The required time for developing may vary from 1 to 30 minutes. Addition of common or Glauber's salt, made before the naphtholated material enters the developing bath, is helpful in preventing crocking (*9*).

5) *Aftertreatment.* Wuterich (*2*) states that after developing and rinsing, the formation of the dyestuff is chemically completed, but the dyeing

is not finished. It undergoes a change when washed at the boil and does not possess as good a fastness to chlorine and to light as an aftertreated dyeing. If the process has been carried out carefully the color lake is finely dispersed in the fiber. During the aftertreatment the color lake undergoes a physical change. Under influence of heat in the presence of water it migrates into the lumen of the cotton fiber, where it agglomerates to form larger particles which are partly crystalline and partly amorphous. This is promoted by addition of agents which have a swelling action on the cotton, such as alkalis and soap or certain saponaceous synthetic products. In a good many cases this results in a marked change in shade, and there is substantial improvement in the fastness properties. This migration occurs especially at high temperatures, at least 158° F, and proceeds most rapidly at temperatures near the boil. It is advisable that the soaping be carried out at as high a temperature as possible. Dispersion of color lake in aftertreating must not be destroyed by excessive boiling, and this is best achieved by increasing the concentration of the ingredient used. Care must be taken that the temperature of the bath, during the first quarter of an hour, does not drop until the change of shade has taken place. Once the shade has changed completely the temperature can be allowed to drop slowly, as the only object to be achieved afterwards is to stop the migration of the color lake particles and to remove from the fiber those which have migrated to the outside and to disperse them. To remove the aftertreating liquor still present in the goods, treat in a hot rinse bath at 140° F to 158° F, containing a dispersing agent to avoid a precipitation of the color lake when the soap concentration is diluted. The first rinse bath is followed by a second one at a temperature of about 104° F to 122° F, and this repeated until the bath remains unstained. It is also recommended that the dyer must use only soft water or use a product which is unaffected by water hardness, so that no additional difficulties caused by formation of lime-soaps have to be dealt with.

Lindsay (*9*) states that rinsing should be carried out cold until the diazo solution is completely removed, then hot water may be used. For cotton piece goods and yarn, he suggests boiling the material for 20-40 minutes, with 3 lbs soap and ½-1 lb of soda ash per 100 gallons of solution. Results are most satisfactory when accompanied by a mechanical treatment, such as is given on rope soaps, which aids the removal of loosely adhering color pigment.

Another investigator (*18*) suggests that rinsing by means of washing machines using spraying tubes is more advisable than rinsing with running water. He found it best to boil with completely softened water and sodium carbonate without any soap. The use of fat acid condensation products or alcohol sulfonation products in addition to the sodium carbonate is also recommended. It was found that aftertreatments with tannic acid render reddish tints turbid and lower their brightness.

Williams (*8*) found that the best aftertreatment is plain boiling water. He suggested using a large overflow with a heavy spray on top of the bath to wash off decomposed developers precipitated by hot water, otherwise, impurities from tarry substances that are very difficult to remove will pick up on the cloth. After hot washing the goods, it is best to aftertreat in as many boxes as available with a boiling solution of Igepon and soda ash. A great many shades have to be rope soaped to produce true shades with the desired fastness to crocking.

Celantano (*7*) states that iron in water gives considerable trouble in regards to crock fastness. An organic sequestering agent should be used whenever water containing iron, calcium, or magnesium comes in contact with naphthol or naphtholated material. He recommends that goods should be soaped at as high a temperature as is feasible for the longest possible time up to 30 minutes in a bath containing 2% on the weight of the fiber of a synthetic detergent that is especially resistant to calcium, magnesium and iron, 4% soda ash, 2% organic sequestering agent. Igepal CA Extra and Nullapon BFC Liquid are recommended. In jig dyeing the temperature of the cloth on the beam is only 170 to 180° F, even when the liquor in the jig is actively boiling, and therefore, it is advisable to continue the aftertreatment for 8 to 10 ends. In kettles where the cloth is subjected to considerable mechanical action because it is in rope form and where a temperature of 190 to 195° F can be maintained, especially if the kettle is closed, an aftertreatment for 20 to 30 minutes, followed by hot rinses, should produce dyeings with very good crocking fastness. In continuous dyeing, aftertreatment is usually carried out in 2 or 3 hot wash boxes containing 1 to 2 lbs of synthetic detergent, 2 to 4 lbs soda ash, and 1 to 2 lbs organic sequestering agent for 100 gallons. The material is finally rinsed in 2 or 3 more wash boxes containing hot running water.

On package-dyed naphthol cotton yarns (*10*), the use of soap and synthetic detergents both by themselves and in combination was studied by comparative tests. Results found in this study were:

1) **Some improvement obtained in crock fastness by the soaping-off operation.**
2) **Better crock fastness obtained by soaping before drying.**
3) **Little improvement obtained by increasing the number of soap baths beyond two.**
4) **Little difference in the crock fastness of yarns soaped at 120 or at 190° F.**
5) **None of the synthetic detergents tried by themselves showed any improvement over soap alone. Some improvement was noted when synthetic detergents of the type such as Stabilon were used along with soap in the second bath.**
6) **Carboxymethylcellulose was not found to improve the crock fastness over soap alone.**
7) **The addition of 1% sodium lignosulfonate, such as Marasperse N, to the soap baths was found to improve the crock fastness somewhat.**

Beam and Rowe (*20*) found that treatment with dilute soap solution with or without sodium carbonate removed loose surface coloring matter and also produced aggregation within the cell wall. If carried on too long, however, the process became reversible and the rubbing fastness was adversely affected.

Williams (*21*) suggested boiling in concentrated soap solution as an aftertreatment.

Nuttall (*11*) used the pad hooked up continuously with a skying arrangement and a continuous washer, such as a soaper or a series of Williams units. The cloth is washed in hot water and finally treated with Stabilon, followed by three becks of boiling water before drying.

In dyeing rayon fabrics (*22*), it was found that best results are obtained by drying the primed textile before and during development and washing it in an apparatus which exerts little strain on the material.

Hirst (*15*) suggests that aftertreatment of dyed goods is very simple. It is only a matter of following the proper procedure to keep the shade and remove the excess naphthol and color lake to prevent crocking and to obtain maximum fastness. A thorough rinse in hot water, followed by a hot

soaping, either at 160° F or as near the boil as possible, depending on the naphthol-developer combination dyed, is sufficient.

A comparison (*10*) has also been made of the nonionic type of softener, such as stearic acid, and/or certain soluble oils with an anionic type of softener, such as Ahcovel E. Definite improvement in crock fastness with the use of an anionic type was found. In this study, no comparison was made with any cationic type of softener since it was found impossible to apply them uniformly to yarn in package form due to their strong substantivity.

C) NEED FOR PRESENT STUDY ——It can be readily seen from the preceding discussion that there is no scarcity of suggestions as to causes of crocking with naphthol dyes and recommendations for methods of alleviating this condition. But it can also be readily seen that many of these recommendations are in direct disagreement with each other. One investigator (*23*) expressed the opinion that this defect in naphthol-dyed goods is not likely to be overcome.

The two aforementioned Intersectional Contest Papers specifically devoted to this problem have shown the need for further study. The New York Section (*6*) investigations of crock fastness have borne out the complexity of the problem by showing that each class of dye and method of application presents its own problem, and indicates the necessity for further intensive work on the many phases of a difficult problem. The South Central Section (*10*) stated that more work was planned in the study of effect of synthetic detergents compared with soap in aftertreatment, and on the effect of sodium lignosulfonate in aftertreatment.

It may be seen that some phases of this problem have received much less consideration than others, for example, the effect of pH of coupling bath, and effect of various finishes applied to naphthol goods.

It is the purpose of this paper to study more thoroughly those phases which have received little or no consideration in previous investigations, and to study those phases which appear to be controversial issues in the results of prior research.

## III EXPERIMENTAL TESTS AND RESULTS

A) EFFECT OF pH OF COUPLING BATH——

*1) Experimental Tests and Procedure.* Extensive interlaboratory tests have been made to determine the effect of pH of coupling on crocking. Six laboratories cooperated in this experiment, with all six laboratories testing the effect of coupling at pH 3, 3.5, 4, 4.5, 5, and 6, with various naphthol and salt combinations.

In order to eliminate as many variables as possible, the same fabric, naphthols and salts were provided to the participating laboratories.

The following procedures were carried out by each participating laboratory:

*Cloth*:

45" 64x60 4.65 sheeting, bleached

*Method of Application*:

1) Pad, dry, and couple
2) Pad and couple wet (no salt rinse)

*Pick-up*: 100%

*Combinations*:

1) Naphthol AS-BR coupled with Fast Red B Salt (Laboratory #1, #4, #6)
2) Naphthol AS-OL coupled with Fast Red B Salt (Laboratory #1, #2, #3)
3) Naphthol AS-BS coupled with Fast Scarlet R Salt (Laboratory #1, #2, #6)
4) Naphthol AS coupled with Fast Scarlet R Salt (Laboratory #1, #3, #5)
5) Naphthol AS-SW coupled with Fast Scarlet R Salt (Laboratory #2)

*Procedure*:

1) Naphthol AS-BR 20%, 10 oz/gal, pad at 190° F
   500 cc mix
   37.5 gms Naphthol AS-BR 20% added to
   400 cc hot water containing
   3 cc caustic soda (50%)
   1 cc Tergitol #4
   made up to 500 cc with water.
   Couple with Fast Red B Salt, 8 oz/gal
   500 cc mix
   30 gms Fast Red B Salt
   1 gm Stabilon
   Paste Fast Red B Salt with Stabilon and 50 cc water.
   Make up to 500 cc with water at 55° F.
   Adjust to desired pH with acetic acid 56% or soda ash.

2) Naphthol AS-OL 20%, 10 oz/gal, pad at 190° F
   500 cc mix
   37.5 gms Naphthol AS-OL 20% added to
   400 cc hot water containing
   3 cc caustic soda (50%)
   1 cc Tergitol #4
   made up to 500 cc with water.
   Couple with Fast Red B Salt, 8 oz/gal as above (#1).

3) Naphthol AS-BS 20%, 10 oz/gal, pad at 190° F
   500 cc mix
   37.5 gms Naphthol AS-BS 20%, added to
   400 cc hot water containing
   3 cc caustic soda (50%)
   1 cc Tergitol #4
   made up to 500 cc with water.
   Couple with Fast Scarlet R Salt, 8.5 oz/gal
   500 cc mix
   32 gms Fast Scarlet R Salt
   1 gm Stabilon
   Paste Fast Scarlet R Salt with Stabilon and 50 cc water.
   Make up to 500 cc with water at 55° F.
   Adjust to desired pH with acetic acid 56% or soda ash.

4) Naphthol AS 25%, 8 oz/gal, pad at 190° F
   500 cc mix
   30 gms Naphthol AS 25% added to
   400 cc hot water containing
   3 cc caustic soda (50%)
   1 cc Tergitol#4
   made up to 500 cc with water.
   Couple with Fast Scarlet R Salt, 8.5 oz/gal as above (#3).

5) Naphthol AS-SW 20%, 10 oz/gal, pad at 190° F
   500 cc mix
   37.5 gms Naphthol AS-SW 20% added to
   20% added to
   400 cc hot water containing
   3 cc caustic soda (50%)
   1 cc Tergitol #4
   made up to 500 cc with water.
   Couple with Fast Scarlet R Salt, 8.5 oz/gal as above (#3).

*For all dyeings*:

Rinse in cold running water until clear.
Soap 30 seconds at 180° F in:
1 oz/gal neutral chip soap (3.75 gms/500 cc)
1 oz/gal soda ash (3.75 gms/500 cc)
Rinse and dry.

Check dry and wet crocking by AATCC Standard Test Method 8-52 (*24*).

*2) Comments.* Data shown in Table I, with combinations #1 through #5, give the comparative crock fastness on these dyeing combinations, as dyed and evaluated by different laboratories.

# TABLE I
## EFFECT OF pH OF COUPLING ON CROCKING*

### Combination #1—Naphthol AS-BR and Fast Red B Salt

| Laboratory | Dry Crock Rating #1 | Dry Crock Rating #4 | Dry Crock Rating #6 | Wet Crock Rating #1 | Wet Crock Rating #4 | Wet Crock Rating #6 |
|---|---|---|---|---|---|---|
| Naphthol AS-BR—dried and coupled with Fast Red B Salt | heavy shade | heavy shade | heavy shade | heavy shade | heavy shade | heavy shade |
| pH 6 | 3-4 | 3 | 3-4 | 2 | 2 | 2 |
| 5 | 4 | 3-4 | 3-4 | 2 | 2 | 2 |
| 4.5 | 4 | — | 3-4 | 2 | — | 2 |
| 4 | 4 | 3-4 | 3-4 | 2 | 2 | 2 |
| 3.5 | 4 | — | 3-4 | 2 | — | 2 |
| 3 | 4 | 3-4 | 3-4 | 2 | 2-3 | 2 |
| Naphthol AS-BR—coupled wet with Fast Red B Salt | heavy shade | heavy shade | heavy shade | heavy shade | heavy shade | heavy shade |
| pH 6 | 3-4 | 3-4 | 3 | 2 | 2-3 | 2 |
| 5 | 4 | 4 | 3 | 2 | 2 | 2 |
| 4.5 | 4 | — | 3 | 2 | — | 2 |
| 4 | 4 | 4 | 3 | 2 | 2-3 | 2 |
| 3.5 | 4 | — | 3 | 2 | — | 2 |
| 3 | 4 | 4 | 3 | 2 | 2-3 | 2 |

### Combination #2—Naphthol AS-OL and Fast Red B Salt

| Laboratory | Dry Crock Rating #1 | Dry Crock Rating #2 | Dry Crock Rating #3 | Wet Crock Rating #1 | Wet Crock Rating #2 | Wet Crock Rating #3 |
|---|---|---|---|---|---|---|
| Naphthol AS-OL—dried and coupled with Fast Red B Salt | heavy shade | light shade | medium shade | heavy shade | light shade | medium shade |
| pH 6 | 4 | 4-5 | 5 | 2-3 | 3-4 | 5 |
| 5 | 4 | 4-5 | 5 | 2-3 | 3-4 | 4 |
| 4.5 | 4 | 4-5 | 5 | 2-3 | 3-4 | 4 |
| 4 | 4 | 4-5 | 5 | 2-3 | 3-4 | 4 |
| 3.5 | 4 | 4-5 | 5 | 2-3 | 4 | 4 |
| 3 | 4 | 4-5 | 5 | 2-3 | 4 | 4 |
| Naphthol AS-OL—coupled wet with Fast Red B Salt | heavy shade | light shade | very light shade | heavy shade | light shade | very light shade |
| pH 6 | 4 | 4 | 5 | 3 | 3-4 | 4 |
| 5 | 4 | 4 | 5 | 3 | 3-4 | 4 |
| 4.5 | 4 | 4 | 5 | 2-3 | 3-4 | 4 |
| 4 | 4 | 4 | 5 | 3 | 3-4 | 4 |
| 3.5 | 4 | 4 | 4 | 3 | 3-4 | 3 |
| 3 | 4 | 4 | 4 | 3 | 3 | 3 |

### Combination #3—Naphthol AS-BS and Fast Scarlet R Salt

| Laboratory | Dry Crock Rating #1 | Dry Crock Rating #2 | Dry Crock Rating #6 | Wet Crock Rating #1 | Wet Crock Rating #2 | Wet Crock Rating #6 |
|---|---|---|---|---|---|---|
| Naphthol AS-BS—dried and coupled with Fast Scarlet R Salt | heavy shade | light shade | medium shade | heavy shade | light shade | medium shade |
| pH 6 | 4 | 4-5 | 4 | 2-3 | 4 | 3 |
| 5 | 4 | 4-5 | 4-5 | 2-3 | 4 | 3 |
| 4.5 | 4 | 4-5 | 4-5 | 2-3 | 4 | 3 |
| 4 | 4 | 4-5 | 4 | 2-3 | 4 | 3 |
| 3.5 | 4 | 4-5 | 4-5 | 2-3 | 4 | 3 |
| 3 | 4 | 4-5 | 4-5 | 2-3 | 4 | 3 |
| Naphthol AS-BS—coupled wet with Fast Scarlet R Salt | heavy shade | light shade | light shade | heavy shade | light shade | light shade |
| pH 6 | 3-4 | 4 | 4-5 | 2-3 | 3-4 | 3 |
| 5 | 3-4 | 4 | 4 | 2-3 | 3-4 | 3 |
| 4.5 | 3-4 | 4-5 | 4 | 3 | 4 | 3 |
| 4 | 3-4 | 4 | 4 | 2-3 | 3-4 | 3 |
| 3.5 | 3-4 | 4 | 4 | 2-3 | 3-4 | 3 |
| 3 | 3-4 | 4 | 4 | 2-3 | 3-4 | 3 |

### Combination #4—Naphthol AS and Fast Scarlet R Salt

| Laboratory | Dry Crock Rating #1 | Dry Crock Rating #3 | Dry Crock Rating #5 | Wet Crock Rating #1 | Wet Crock Rating #3 | Wet Crock Rating #5 |
|---|---|---|---|---|---|---|
| Naphthol AS—dried and coupled with Fast Scarlet R Salt | light shade | light shade | very light shade | light shade | light shade | very light shade |
| pH 6 | 4-5 | 5 | 5 | 3 | 4 | 3 |
| 5 | 4-5 | 5 | 5 | 3 | 4 | 4-5 |
| 4.5 | 4-5 | 5 | 4-5 | 3 | 5 | 3 |
| 4 | 4-5 | 5 | 4-5 | 3 | 4 | 3 |
| 3.5 | 4-5 | 5 | 4-5 | 3 | 4 | 3 |
| 3 | 4-5 | 5 | 4-5 | 3 | 4 | 3 |
| Naphthol AS—coupled wet with Fast Scarlet R Salt | light shade | light shade | light shade | light shade | light shade | light shade |
| pH 6 | 4-5 | 5 | 4-5 | 3-4 | 4 | 3-4 |
| 5 | 4-5 | 5 | 4-5 | 3-4 | 4 | 3 |
| 4.5 | 4-5 | 4 | 4-5 | 3 | 4 | 3 |
| 4 | 4-5 | 5 | 4-5 | 3 | 4 | 3 |
| 3.5 | 4-5 | 4 | 4-5 | 3 | 3 | 3 |
| 3 | 4-5 | 4 | 4-5 | 3 | 3 | 2-3 |

*(Table I continued on P293)*

## TABLE I (Concluded)
## EFFECT OF pH OF COUPLING ON CROCKING*

**Combination #5—Naphthol AS-SW and Fast Scarlet R Salt**

| Laboratory | Dry Crock Rating #2 | Wet Crock Rating #2 |
|---|---|---|
| Naphthol AS-SW—dried and coupled with Fast Scarlet R Salt | medium shade | medium shade |
| pH 6 | 4-5 | 4 |
| 5 | 4-5 | 4 |
| 4.5 | 4-5 | 3-4 |
| 4 | 4-5 | 4 |
| 3.5 | 4-5 | 4 |
| 3 | 4-5 | 4 |
| Naphthol AS-SW—coupled wet with Fast Scarlet R Salt | medium shade | medium shade |
| pH 6 | 4-5 | 3-4 |
| 5 | 4-5 | 3-4 |
| 4.5 | 4-5 | 3-4 |
| 4 | 4-5 | 3-4 |
| 3.5 | 4-5 | 3-4 |
| 3 | 4-5 | 3-4 |

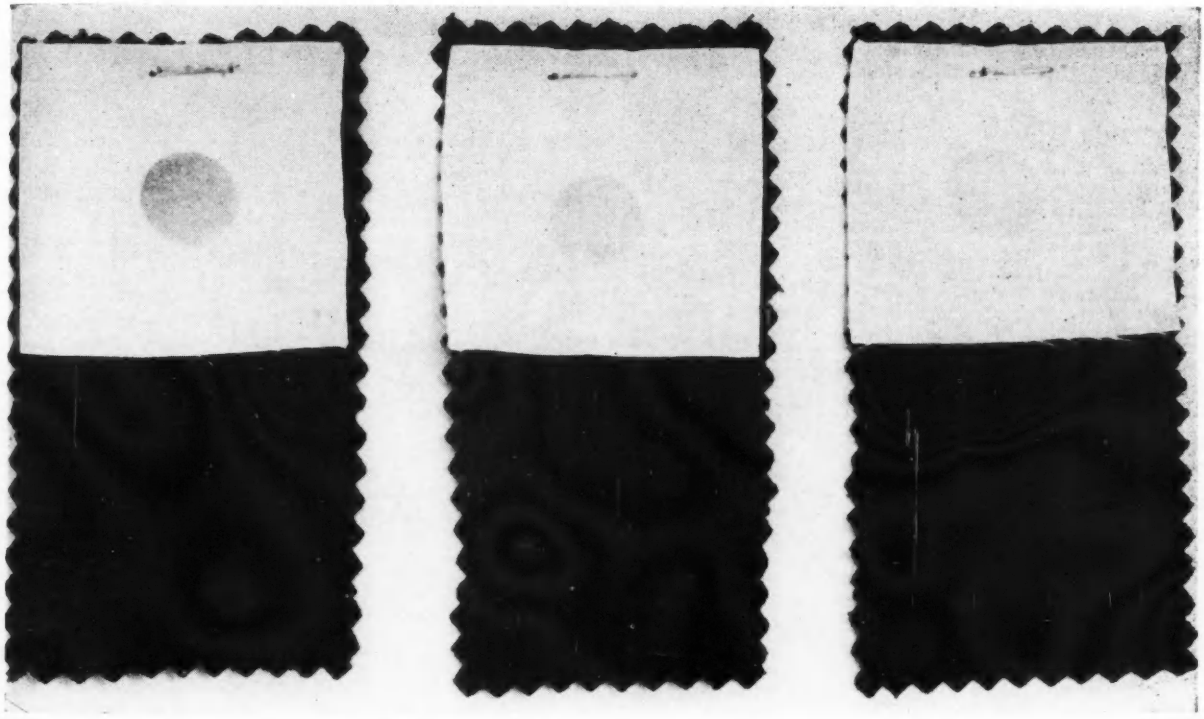
*Rating: 5—Very good
4—Good
3—Fair
2—Poor
1—Very poor

In general, coupling at various pH values in the range of 3 to 6 does not affect crocking values to any great extent, but does affect the shade when outside the range of 3.5-5.0 (Figure 1).

Dry coupling with these naphthols gives better crock fastness, and heavier and more uniform shades than wet coupling (Figure 2).

Dry coupling at pH 4.5 shows a trend to a more uniform depth of shade.

Naphthol AS-BR and Fast Red B Salt combination gave poorer crock fastness than the other combinations tested in this series, and is the only combination that showed poorer crock fastness at pH 5 and 6 than at the lower pH values.



pH 6
Dry crock rating 3-4

pH 4.5
Dry crock rating 4

pH 3
Dry crock rating 4

**Figure 1**
**Effect of pH of coupling on crock fastness**
**Naphthol AS-BR—dried and coupled with Fast Red B Salt**

3) *Results.* Results from these interlaboratory tests indicate that the pH of the coupling bath has very little effect on the crock fastness of these combinations, but does affect the shade considerably when outside the range pH 3.5-5.0.

B) EFFECT OF TEMPERATURE AND STANDING TIME OF COUPLING BATH———

1) *Experimental Tests and Procedure.* Laboratory tests have been made to determine the effect of temperature and standing time of coupling bath on crock fastness of naphthol colors.

All experiments were made and evaluated by one laboratory in this series of tests.

The following procedures were used for these experiments:

*Cloth*:

45″ 64x60 4.65 sheeting, bleached (combinations #1 and #2)
Bleached corduroy (combination #3)

*Combinations*:

1) Naphthol AS-BR coupled with Fast Red B Salt
2) Naphthol AS-BS coupled with Fast Scarlet R Salt
3) Naphthol AS-D coupled with Fast Red KB Base

*Procedure*:

Naphtholating and coupling solutions are made up the same as in section III, A, 1.

1) *Naphthol AS-BR*—Dyeings made on sheeting using Naphthol AS-BR coupled dry with Fast Red B Salt at 32, 60 and 80° F, with fresh coupling bath and with coupling bath after standing 2 and 7 hours.
2) *Naphthol AS-BS*—Dyeings made on sheeting using Naphthol AS-BS coupled dry with Fast Scarlet R Salt at 32, 60, 80, and 100° F, with fresh coupling bath and with coupling bath after standing 2 hours.
3) *Naphthol AS-D*—Dyeings made on corduroy using Naphthol AS-D coupled dry with Fast Red KB Base at 40, 60, 80, and 120° F, with fresh coupling bath and with coupling bath after standing 3 hours.

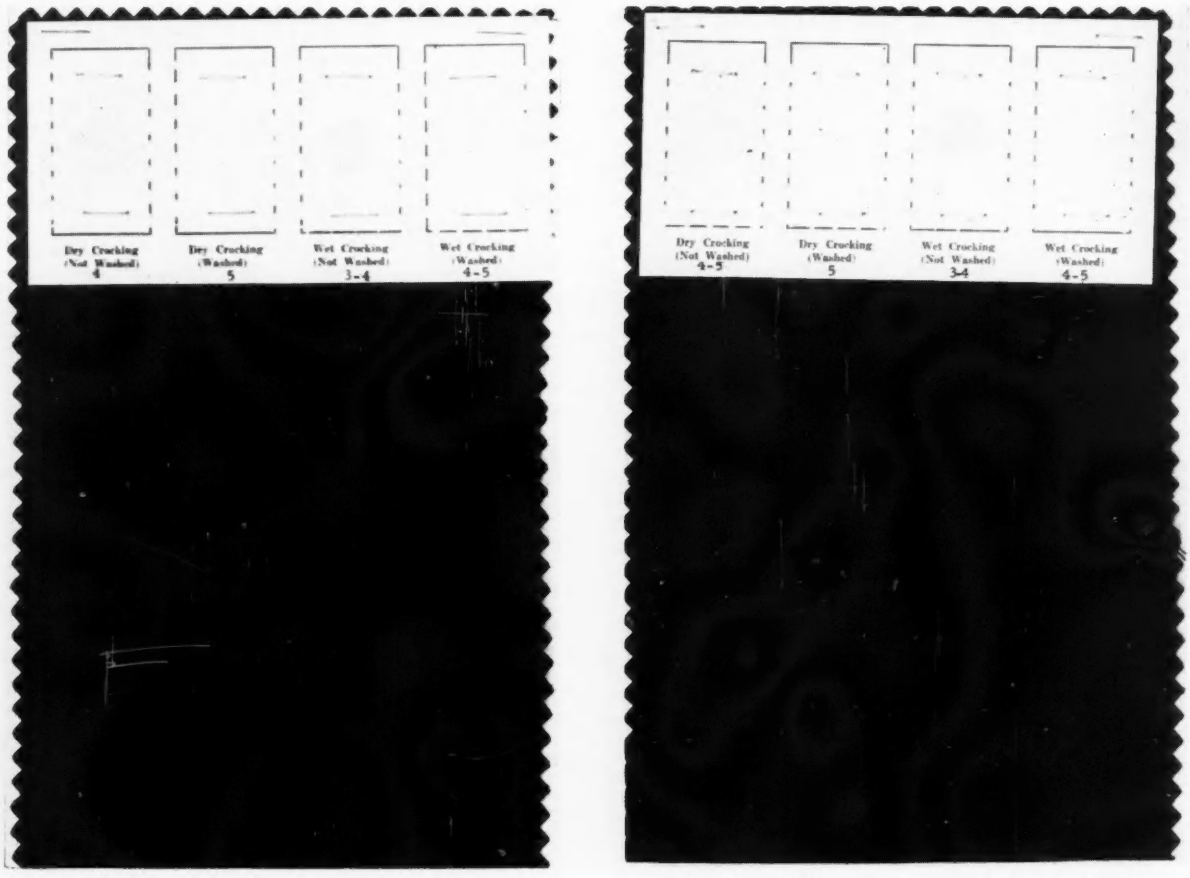
*For all dyeings*:

Rinsing and soaping procedure is the same as in section III, A, 1.

Check dry and wet crocking by AATCC Standard Test Method 8-52 (*24*).

2) *Comments.* Data are shown in Table II, combinations #1 through #3.

Laboratory dyeings on sheetings using Naphthol AS-BR coupled with Fast Red B Salt at 32, 60, and 80° F, with fresh coupling bath and with coupling bath after standing 2 and 7 hours, indicate that the shade is slightly lower with increasing standing time and temperature, but there is no ap-


Dry Crocking (Not Washed) 4
Dry Crocking (Washed) 5
Wet Crocking (Not Washed) 3-4
Wet Crocking (Washed) 4-5
Dry Crocking (Not Washed) 4-5
Dry Crocking (Washed) 5
Wet Crocking (Not Washed) 3-4
Wet Crocking (Washed) 4-5

Naphthol AS-OL—dried and coupled with Red B Salt—pH 4.5

Naphthol AS-OL—coupled wet with Red B Salt pH 4.5

**Figure 2**
**Comparison of dry coupling with wet coupling**

preciable difference in crock fastness.

Similar dyeings using Naphthol AS-BS coupled with Fast Scarlet R Salt, fresh and after 2 hours, at 32, 60, 80, and 100° F, indicate no appreciable difference in crock fastness, but the shade is lighter with increasing time and temperature (Figure 3).

Laboratory dyeings on bleached corduroy using Naphthol AS-D coupled with Fast Red KB Base at 40, 60, 80, and 120° F, with fresh bath and

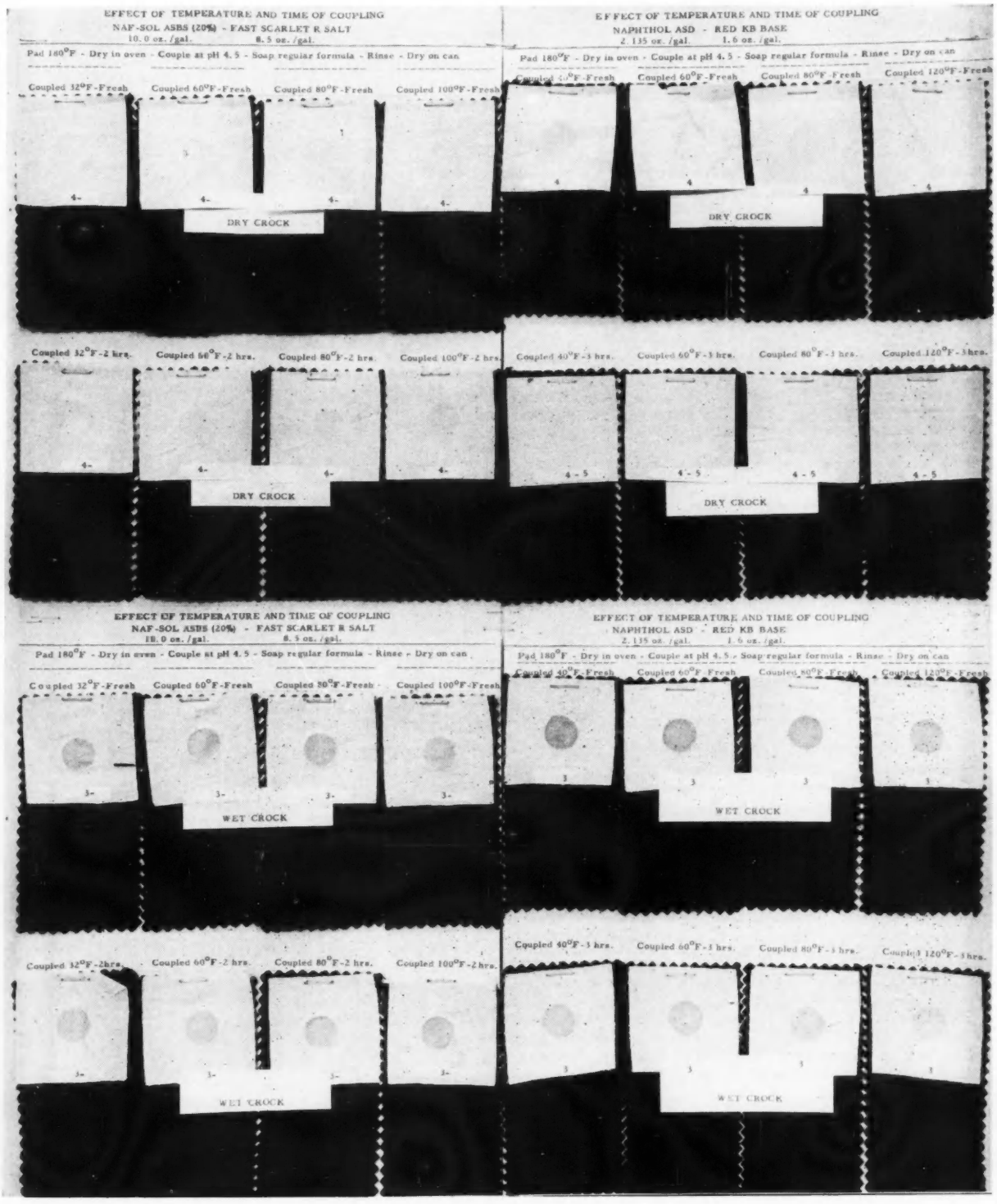

EFFECT OF TEMPERATURE AND TIME OF COUPLING
NAF-SOL ASBS (20%) - FAST SCARLET R SALT
10.0 oz./gal. 8.5 oz./gal.
Pad 180°F - Dry in oven - Couple at pH 4.5 - Soap regular formula - Rinse - Dry on can
Coupled 32°F-Fresh
Coupled 60°F-Fresh
Coupled 80°F-Fresh
Coupled 100°F-Fresh
DRY CROCK
EFFECT OF TEMPERATURE AND TIME OF COUPLING
NAPHTHOL ASD - RED KB BASE
2.135 oz./gal. 1.6 oz./gal.
Pad 180°F - Dry in oven - Couple at pH 4.5 - Soap regular formula - Rinse - Dry on can
Coupled 60°F-Fresh
Coupled 80°F-Fresh
Coupled 120°F-Fresh
DRY CROCK
Coupled 32°F-2 hrs.
Coupled 60°F-2 hrs.
Coupled 80°F-2 hrs.
Coupled 100°F-2 hrs.
DRY CROCK
Coupled 40°F-3 hrs.
Coupled 60°F-3 hrs.
Coupled 80°F-3 hrs.
Coupled 120°F-3 hrs.
DRY CROCK
EFFECT OF TEMPERATURE AND TIME OF COUPLING
NAF-SOL ASBS (20%) - FAST SCARLET R SALT
10.0 oz./gal. 8.5 oz./gal.
Pad 180°F - Dry in oven - Couple at pH 4.5 - Soap regular formula - Rinse - Dry on can
Coupled 32°F-Fresh
Coupled 60°F-Fresh
Coupled 80°F-Fresh
Coupled 100°F-Fresh
WET CROCK
EFFECT OF TEMPERATURE AND TIME OF COUPLING
NAPHTHOL ASD - RED KB BASE
2.135 oz./gal. 1.6 oz./gal.
Pad 180°F - Dry in oven - Couple at pH 4.5 - Soap regular formula - Rinse - Dry on can
Coupled 40°F-Fresh
Coupled 60°F-Fresh
Coupled 80°F-Fresh
Coupled 120°F-Fresh
WET CROCK
Coupled 32°F-2hrs.
Coupled 60°F-2 hrs.
Coupled 80°F-2 hrs.
Coupled 100°F-2 hrs.
WET CROCK
Coupled 40°F-3 hrs.
Coupled 60°F-3 hrs.
Coupled 80°F-3 hrs.
Coupled 120°F-3 hrs.
WET CROCK

**Figure 3**
**Effect of temperature and standing time of coupling bath**

## TABLE II
## EFFECT OF TEMPERATURE AND STANDING TIME OF COUPLING BATH*

**Combination #1—Naphthol AS-BR and Fast Red B Salt**

| Coupled | Dry crock rating | | | Wet crock rating | | |
|---|---|---|---|---|---|---|
| | Fresh | After 2 hrs | After 7 hrs | Fresh | After 2 hrs | After 7 hrs |
| Temperature (°F) | | | | | | |
| 32 | 3 | 3+ | 3 | 2 | 2 | 2 |
| 60 | 3 | 3 | 3 | 2 | 2 | 2 |
| 80 | 3+ | 3+ | 3 | 2 | 2 | 2 |

**Combination #2—Naphthol AS-BS and Fast Scarlet R Salt**

| Coupled | Dry crock rating | | Wet crock rating | |
|---|---|---|---|---|
| | Fresh | After 2 hrs | Fresh | After 2 hrs |
| Temperature (°F) | | | | |
| 32 | 4— | 4— | 3— | 3— |
| 60 | 4— | 4— | 3— | 3 |
| 80 | 4— | 4— | 3— | 3— |
| 100 | 4— | 4— | 3— | 3— |

**Combination #3—Naphthol AS-D and Fast Red KB Base**

| Temperature | 40°F | 60°F | 80°F | 120°F |
|---|---|---|---|---|
| Dry Crock Rating | | | | |
| Coupled fresh | 4 | 4 | 4 | 4 |
| Coupled after 3 hours | 4-5 | 4-5 | 4-5 | 4-5 |
| Wet Crock Rating | | | | |
| Coupled fresh | 3 | 3 | 3 | 3 |
| Coupled after 3 hours | 3 | 3 | 3 | 3 |
| Spectrophotometer Readings—% Brightness* | | | | |
| Coupled fresh | 9.05 | 8.55 | 8.80 | 8.40 |
| Coupled after 3 hours | 9.35 | 9.45 | 9.25 | 13.70 |
| Coupling Bath Appearance | | | | |
| Fresh | clear | clear | clear | very cloudy |
| After 3 hours | clear | faintly cloudy | very cloudy | tarry |
| AATCC #3 Wash Test | | | | |
| Coupled fresh | | | | |
| shade | good | good | good | good |
| stain | 4-5 | 4-5 | 4-5 | 4-5 |
| Coupled after 3 hours | | | | |
| shade | good | good | good | good |
| stain | 4-5 | 4-5 | 4-5 | 4-5 |

* Y Values (Black—0%; White—100%)

*Rating: 5—Very good
4—Good
3—Fair
2—Poor
1—Very poor

after standing 3 hours, indicate the shade is adversely affected by higher temperatures and standing time, but crocking and wash fastness are not affected. The coupling bath appears to be more stable at lower temperatures, with less sediment and color build-up in soaping box. Tarring occurred at temperatures above 100° F. It was found that shade and fastness properties are good if coupled fresh, even up to temperatures of 120° F, but bath keeps better in feed tank when running for 2-3 hours if temperature is held below 60° F.

*3) Results.* These studies indicate that the temperature of a fresh coupling bath has very little effect on crocking, but the shade is adversely affected by standing time and high temperatures. Tarring occurs at temperatures above 100° F.

C) EFFECT OF VARIATIONS IN RINSING WITH AND WITHOUT STEAMING THE NAPHTHOL BEFORE COUPLING———

*1) Experimental Tests and Procedure.* Experiments were carried out by one laboratory to determine the effect of variations in rinsing after naphtholation, with and without steaming the naphthol before coupling.

The following procedure was used:

*Cloth*:

45" 64x60 4.65 Sheeting, bleached

*Combinations*:

1) Naphthol AS-BR coupled with Fast Red B Salt
2) Naphthol AS-OL coupled with Fast Red B Salt

*Procedure*:

Naphthol AS-BR padded at 140° F and 180° F.
Naphthol AS-OL padded at 180° F.

1) Dried, coupled with Fast Red B Salt, and rinsed hot and cold before soaping at boil.
2) Steamed using 140° F and 180° F water seal containing 5 oz/gal common salt, dried, coupled with Fast Red B Salt, and rinsed hot and cold before soaping at boil.

Check dry and wet crocking by AATCC Standard Test Method 8-52 (*24*).

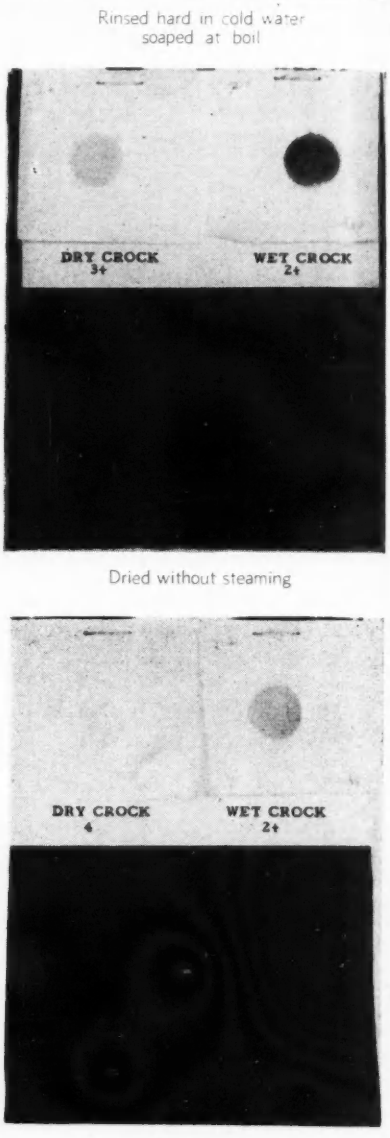



**Figure 4a**
**Effect of variations in rinsing with and without steaming the naphthol before coupling**
**Naphthol AS-BR and Fast Red B Salt—padded at 140° F**

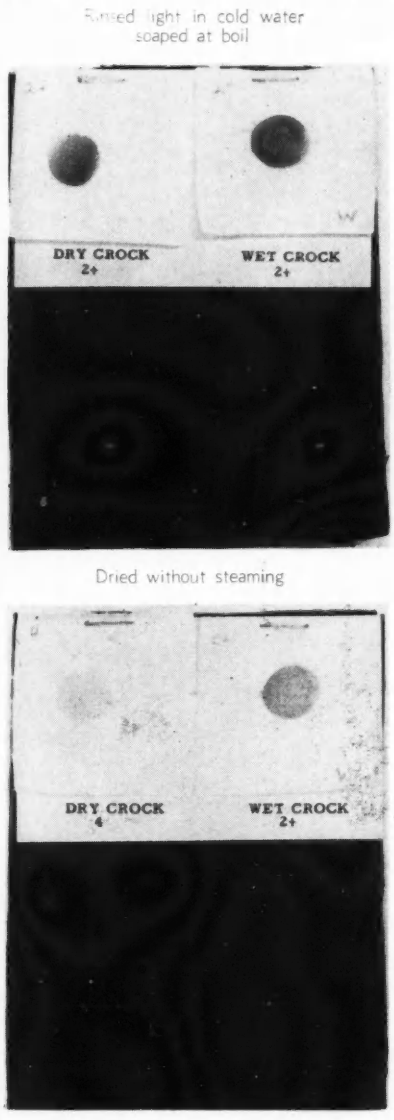



**Figure 4b**
**Effect of variations in rinsing with and without steaming the naphthol before coupling**

**Naphthol AS-BR and Fast Red B Salt—padded at 140° F**

**TABLE III**
**EFFECT OF VARIATIONS IN RINSING WITH AND WITHOUT STEAMING THE NAPHTHOL BEFORE COUPLING**

| | Crock Rating Dry | Wet |
|---|---|---|
| **Combination #1—Naphthol AS-BR and Fast Red B Salt—Padded at 140° F** | | |
| Dried without steaming | | |
| No rinse—soaped at boil | 3 | 2+ |
| Rinsed hard in cold water—soaped at boil | 3+ | 2+ |
| Rinsed light in cold water—soaped at boil | 2+ | 2+ |
| Rinsed hard 190°F—soaped at boil | 3— | 2+ |
| Steamed using 140°F water seal containing 5 oz/gal NaCl and dried | | |
| No rinse—soaped at boil | 3 | 3— |
| Rinsed hard in cold water—soaped at boil | 4— | 2+ |
| Rinsed light in cold water—soaped at boil | 4— | 2+ |
| Rinsed hard 190°F—soaped at boil | 4 | 2+ |
| Steamed using 180°F water seal containing 5 oz/gal NaCl and dried | | |
| No rinse—soaped at boil | 3 | 2+ |
| Rinsed hard in cold water—soaped at boil | 4 | 2+ |
| Rinsed light in cold water—soaped at boil | 4— | 2+ |
| Rinsed hard 190°F—soaped at boil | 4— | 2+ |
| Steamed without water seal | | |
| Rinsed hard in cold water—soaped at boil | 4 | 2+ |
| Rinsed light in cold water—soaped at boil | 4 | 2+ |
| Steamed without water seal after naphtholating, dried, coupled, steamed without water seal | | |
| Rinsed light in cold water—soaped at boil | 4 | 2+ |
| **Combination #2—Naphthol AS-BR and Fast Red B Salt—Padded at 180° F** | | |
| Dried without steaming | | |
| Rinsed hard in cold water—soaped at boil | 3— | 2 |
| Rinsed hard 190°F—soaped at boil | 2+ | 2 |
| **Combination #2—Naphthol AS-OL and Fast Red B Salt—Padded at 180°F** | | |
| Dried without steaming | | |
| No rinse—soaped at boil | 4— | 3 |
| Rinsed hard in cold water—soaped at boil | 4+ | 3 |
| Rinsed light in cold water—soaped at boil | 4 | 3 |
| Rinsed hard 190°F—soaped at boil | 4+ | 3 |
| Steamed using 180°F water seal containing 5 oz/gal NaCl and dried | | |
| No rinse—soaped at boil | 5— | 3+ |
| Rinsed hard in cold water—soaped at boil | 5— | 4 |
| Rinsed light in cold water—soaped at boil | 5— | 4 |
| Rinsed hard 190°F—soaped at boil | 5— | 3+ |

Rating: 5—Very good, 4—Good, 3—Fair, 2—Poor, 1—Very poor

2) *Comments.* Table III, with combinations #1 and #2, shows results of dry and wet crock ratings on these experiments.

In combination #1, Naphthol AS-BR coupled with Fast Red B Salt, the crock fastness showed improvement only when the naphthol was steamed at 220° F for 45 seconds before drying and coupling. The shade was brighter and as heavy or heavier when the naphthol was steamed before drying (Figure 4).

When the temperature of the water seal was held at 140° F, sufficient pad color (naphthol mixture) and common salt had to be added to water seal at start of run to eliminate strip off.

Variations in rinsing and soaping did not show much change in the crock fastness.

In combination #2, Naphthol AS-OL coupled with Fast Red B Salt, the steamed dyeing was a little lighter in shade than the unsteamed dyeing, and the crock fastness was a little better with the steamed dyeing.

3) *Results.* In general, steaming before coupling in these experiments improves crock fastness slightly. Rinsing hot as compared with cold before soaping gives about the same crock fastness.

D) EFFECT OF SOAPING METHODS WITH VARIATIONS IN TEMPERATURE AND DETERGENTS

1) *Experimental Tests and Procedure.* The controversial nature of the previous literature with regard to soaping method indicated a need for further study on the effect of soaping methods on crock fastness.

A series of laboratory experiments were carried out to determine the effect of soaping methods with variations in temperature and detergents.

The following procedures were used:

*Cloth:*

Corduroy and Twill

*Combinations:*

1) Naphthol AS-BR and Naphthol AS-OL coupled with Fast Garnet GBC Base
2) Naphthol AS coupled with Fast Red 3GL Salt

*Procedure:*

1) Naphthol AS-BR and Naphthol AS-OL coupled with Fast Garnet GBC Base

Naphtholating Bath:
2.5 oz/gal Naphthol AS-BR 20%
5.0 oz/gal Naphthol AS-OL 20%
Pad at 180° F, dry in oven

Couple:
3.45 oz/gal Fast Garnet GBC Base at 60° F.

Wash:
2 boxes cold water
1 box soaping mixture at stated temperature
1 box water at 160° F
1 box soaping mixture at stated temperature
4 boxes water at 160° F
Dry on cans

Soaping Mixtures:
(a) Water only, 80° F
(b) Water only, 140° F
(c) Water only, 200° F
(d) 0.8% chip soap
0.8% soda ash, at 80° F
(e) Same mixture as (d), at 140° F
(f) Same mixture as (d), at 200° F
(g) 0.4% sulfated fatty alcohol
0.4% chip soap
0.8% soda ash, at 80° F
(h) Same mixture as (g), at 140° F
(i) Same mixture as (g), at 200° F
(j) 0.3% sodium alkylarylsulfonate
0.3% Stabilon
0.3% acetic acid, at 80° F
(k) Same mixture as (j), at 140° F
(l) Same mixture as (j), at 200° F
(m) 1.0% sodium lignosulfonate
0.8% chip soap
0.8% soda ash, at 80° F
(n) Same mixture as (m), at 140° F
(o) Same mixture as (m), at 200° F

Part of each sample was brushed with a small bristle laundry brush, after soaping and drying, and just before crocking.

2) Naphthol AS coupled with Fast Red 3GL Salt

Naphtholating Bath:
8.0 oz/gal Naphthol AS 25%
Pad at 180° F, dry in oven

Couple:
8.5 oz/gal Fast Red 3GL Salt at 60° F

**Figure 5**
**Effect of soaping with variations in temperature and detergents Naphthol AS and Fast Red 3GL Salt**

Wash:
2 boxes cold water
1 box soaping mixture at stated temperature
1 box water at 160° F
1 box soaping mixture at stated temperature
4 boxes water at 160° F
Dry on cans

Soaping Mixtures:
(a) Water only, 80° F
(b) Water only, 140° F
(c) Water only, 200° F
(d) 0.8% chip soap
0.8% soda ash, at 80° F
(e) Same mixture as (d), at 140° F
(f) Same mixture as (d), at 200° F
(g) 0.3% sodium alkylarylsulfonate
0.3% Stabilon
0.3% acetic acid, at 80° F

(h) Same as mixture (g), at 140° F
(i) Same mixture as (g), at 200° F

Check dry and wet crocking by AATCC Standard Test Method 8-52 (*24*).

2) *Comments.* Table IV, combinations #1 and #2, show results of these experiments.

These results indicate that chip soap

## TABLE IV A
## EFFECT OF SOAPING METHODS WITH VARIATIONS IN TEMPERATURE AND DETERGENTS

| Soaping mixture | Water only | | | 0.8% chip soap 0.8% soda ash | | | 0.4% sulfated fatty alcohol 0.4% chip soap 0.8% soda ash | | | 0.3% sodium alkylarylsulfonate 0.3% Stabilon 0.3% acetic acid | | | 1.0% sodium lignosulfonate 0.8% chip soap 0.8% soda ash | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperature, °F | 80 | 140 | 200 | 80 | 140 | 200 | 80 | 140 | 200 | 80 | 140 | 200 | 80 | 140 | 200 |
| **Combination #1—Naphthol AS-BR, Naphthol AS-OL and Fast Garnet GBC Base** | | | | | | | | | | | | | | | |
| Corduroy: | | | | | | | | | | | | | | | |
| Dry crock rating | | | | | | | | | | | | | | | |
| Not brushed | 3+ | 3+ | 3+ | 4— | 4— | 4 | 3+ | 4— | 4— | 3+ | 3+ | 3+ | 4— | 4— | 4 |
| Brushed | 3+ | 3+ | 4— | 4— | 4 | 4 | 4— | 4 | 4 | 4— | 4— | 4— | 4— | 4 | 4 |
| Wet crock rating | | | | | | | | | | | | | | | |
| Not brushed | 2— | 2— | 2— | 2— | 2 | 2 | 2— | 2 | 2 | 2— | 2— | 2— | 2— | 2 | 2 |
| Brushed | 2— | 2— | 2— | 2— | 2 | 2 | 2— | 2 | 2 | 2— | 2— | 2 | 2— | 2 | 2 |
| AATCC #3 Wash Test | | | | | | | | | | | | | | | |
| Shade change | fair | fair | fair | fair | fair-good | good | fair | fair-good | good | fair | fair | fair-good | fair | fair-good | good |
| Stain | 3— | 3 | 3 | 3 | 3+ | 4— | 3 | 3+ | 4— | 3 | 3 | 3 | 3 | 3+ | 4— |
| Twill: | | | | | | | | | | | | | | | |
| Dry crock rating | | | | | | | | | | | | | | | |
| Not brushed | 4 | 4 | 4+ | 4 | 4+ | 4+ | 4 | 4+ | 4+ | 4 | 4+ | 4+ | 4 | 4+ | 4+ |
| Brushed | 4 | 4+ | 4+ | 4+ | 4+ | 4+ | 4+ | 4+ | 4+ | 4+ | 4+ | 4+ | 4+ | 4+ | 4+ |
| Wet crock rating | | | | | | | | | | | | | | | |
| Not brushed | 3— | 3— | 3— | 3— | 3— | 3— | 3— | 3— | 3— | 3— | 3— | 3— | 3— | 3— | 3— |
| Brushed | 3— | 3— | 3— | 3— | 3— | 3— | 3— | 3— | 3— | 3— | 3— | 3— | 3— | 3— | 3— |
| AATCC #3 Wash Test | | | | | | | | | | | | | | | |
| Shade change | good | good | good | good | good | good | good | good | good | good | good | good | good | good | good |
| Stain | 3— | 3 | 3 | 3 | 3+ | 3+ | 3 | 3+ | 3+ | 3 | 3 | 3 | 3 | 3+ | 3+ |
| **Combination #2—Naphthol AS and Fast Red 3GL Salt** | | | | | | | | | | | | | | | |
| Corduroy: | | | | | | | | | | | | | | | |
| Dry crock rating | 4— | 4 | 4+ | 4+ | 5— | 5— | | | | 4 | 4+ | 4+ | | | |
| Wet crock rating | 3 | 3 | 3+ | 3+ | 4— | 4— | | | | 3 | 3+ | 3+ | | | |
| AATCC #3 Wash Test | fair | fair | fair-good | fair-good | good | good | | | | fair-good | fair-good | good | | | |
| Shade change | | | | | | | | | | | | | | | |
| Stain | 4 | 4 | 4 | 4 | 4 | 4+ | | | | 4 | 4 | 4 | | | |
| Twill: | | | | | | | | | | | | | | | |
| Dry crock rating | 3+ | 3+ | 4+ | 4+ | 5— | 5— | | | | 3+ | 3+ | 4+ | | | |
| Wet crock rating | 3+ | 3+ | 3+ | 3+ | 4— | 4— | | | | 3 | 3+ | 3+ | | | |
| AATCC #3 Wash Test | | | | | | | | | | | | | | | |
| Shade change | good | good | good | good | good | good | | | | good | good | good | | | |
| Stain | 4 | 4 | 4 | 4 | 4+ | 4+ | | | | 4 | 4 | 4 | | | |

Rating: 5—Very good
4—Good
3—Fair
2—Poor
1—Very poor

## TABLE IV B
## EFFECT OF SOAPING METHODS WITH VARIATIONS IN TEMPERATURE AND DETERGENTS
## EFFECT OF VARIOUS SOAPING COMBINATIONS AT 200° F

### Comparison of Spectrophotometer Values—Brightness Based on Y Values*

| Spectrophotometer values | X (Red) | | Y (Green) | | | Z (Blue) | |
|---|---|---|---|---|---|---|---|
| AATCC #3 wash test | Before wash | After wash | Before wash | After wash | Color loss on washing** | Before wash | After wash |
| **Combination #1—Naphthol AS-BR, Naphthol AS-OL and Fast Garnet GBC Base** | | | | | | | |
| Soaping mixtures, at 200° F | | | | | | | |
| Water only | 3.30 | 3.45 | 1.82 | 1.95 | 0.13 | 1.66 | 2.10 |
| 0.8% chip soap, 0.8% soda ash | 3.30 | 3.45 | 1.87 | 1.95 | 0.08 | 1.70 | 2.15 |
| 0.3% sodium alkylarylsulfonate, 0.3% Stabilon, 0.3% acetic acid | 2.56 | 3.20 | 1.46 | 1.85 | 0.39 | 1.38 | 2.05 |
| **Combination #2—Naphthol AS and Fast Red 3GL Salt** | | | | | | | |
| Soaping mixtures, at 200° F | | | | | | | |
| Water only | 18.80 | 19.60 | 9.90 | 10.30 | 0.40 | 2.95 | 2.95 |
| 0.8% chip soap, 0.8% soda ash | 20.00 | 20.00 | 10.40 | 10.50 | 0.10 | 2.92 | 2.95 |
| 0.3% sodium alkylarylsulfonate, 0.3% Stabilon, 0.3% acetic acid | 18.20 | 18.95 | 9.50 | 9.87 | 0.37 | 2.85 | 2.85 |

*Y Values—% Brightness, 100%—White, 0%—Black
**% Brightness Gain

gives a better crock fastness than plain water or acidified synthetic detergent solution, and also a slight improvement in wash fastness (Figure 5). Replacing part of chip soap with synthetic detergent is equally good and indicates a combination to avoid increased crocking caused by insoluble soap formation from use of hard water.

Brightness of shade is also improved by alkaline soap scouring, but not with synthetic detergent-acetic acid solution. In fact, the latter may be even darker than plain water, with detriment to wash fastness, as shown in spectrophotometer evaluations and other data.

Soaping at higher temperatures gave a slight trend to improved crocking. The higher temperature wash at 200° F was slightly better in crock fastness than the wash at 140° F on the Naphthol AS and Fast Red 3GL Salt combination but was about equal on the Naphthol AS-BR and Naphthol AS-OL coupled with Fast Garnet GBC Base combination. This means that selection of best soaping procedure should be determined experimentally for each dyeing combination.

Results show higher rating for dyed twills than corduroys, probably due to mercerization and difference in construction.

Addition of sodium lignosulfonate, mentioned in the literature, did not improve crock fastness.

Occasionally differences in crock ratings were also found in the same sample when tests were made a few inches apart. This unexpected nonuniformity in a few samples of both laboratory- and plant-dyed goods was eliminated by brushing.

3) *Results.* Results indicate that, in general, alkali soap mixtures at higher temperatures are better for soaping naphthols than synthetic detergents or plain water.

E) EFFECT OF ALCOHOL ADDITION TO COUPLING BATH ON MERCERIZED AND UNMERCERIZED FABRIC———

1) *Experimental Tests and Procedure.* Isopropyl alcohol has been recommended for stabilizing naphthol developing baths.

Laboratory experiments have been made to determine the effect on crocking of adding alcohol to the coupling bath. This effect was studied on mercerized and unmercerized fabrics, with fresh and old coupling bath.

The following procedures were used:

*Cloth*:

Mercerized and unmercerized corduroy

*Combinations*:

Naphthol AS-D coupled with Fast Red KB Base

*Procedure*:

Naphtholating Bath:
2.5 oz/gal Naphthol AS-D
Pad at 190° F

Couple:

1.6 oz/gal Fast Red KB Base

Laboratory dyeings were made on mercerized and unmercerized corduroy using Naphthol AS-D coupled with Fast Red KB Base solution, with and without isopropyl alcohol in fresh coupling bath at 60° F, and again in same coupling bath after standing 16 hours at 60° F.

Samples were rinsed, soaped, rinsed and dried as in Section III, A, 1.

Part of each sample was brushed with a small bristle laundry brush, after soaping and drying, and just before crocking.

Check dry and wet crocking by AATCC Standard Test Method 8-52 (*24*).

2) *Comments.* Results of these experiments are given in Table V.

There appears to be little difference in crock fastness in the samples coupled with base containing alcohol and those coupled with base containing no isopropyl alcohol, although a lighter shade was obtained in the samples with no alcohol (Figure 6).

Brushing the fabric after soaping and drying appears to remove the loosely fixed dyestuff of the unmercerized goods, thus improving the crock fastness, especially on the samples coupled in bath left standing for 16 hours at 60° F.

A heavier shade and slightly better dry crock fastness was obtained with mercerized than with unmercerized fabric, when coupled in either fresh or old baths. Less color in soaping bath and rinse water indicated less loose naphthol dye on mercerized than on unmercerized goods.

Wash fastness was practically the same in all samples, with and without alcohol addition, on mercerized and unmercerized goods.

3) *Results.* Isopropyl alcohol does not stabilize Fast Red KB Base coupling bath, but does somewhat deepen the shade produced.

Mercerized goods give a heavier shade and slightly better dry crock fastness than unmercerized goods.

F) EFFECT OF VARIOUS DYEING COMBINATIONS———

1) *Experimental Tests and Procedure.* In the experiments on effect of pH of coupling on crock fastness, it was found that dry coupling at pH 4.5 gave a more uniform depth of shade than coupling at other pH values. and that some combinations showed poorer crock fastness than other combinations. It was felt advis-

**TABLE V**
**EFFECT OF ALCOHOL ADDITION TO COUPLING BATH ON MERCERIZED AND UNMERCERIZED GOODS**

| | Unmercerized goods | | Mercerized goods | |
|---|---|---|---|---|
| | 15% Isopropyl alcohol in coupling bath | No alcohol in coupling bath | 15% Isopropyl alcohol in coupling bath | No alcohol in coupling bath |
| **Combination—Naphthol AS-D and Fast Red KB Base** | | | | |
| Dry crock rating | | | | |
| Coupled fresh at 60°F | | | | |
| Brushed | 4+ | 4+ | 5— | 5— |
| Not brushed | 3+ | 4 | 4+ | 4+ |
| Coupled after 16 hours at 60°F | | | | |
| Brushed | 4+ | 4+ | 5— | 5— |
| Not brushed | 3 | 3 | 4+ | 4+ |
| Wet crock rating | | | | |
| Coupled fresh at 60°F | 3 | 3 | 3 | 3 |
| Coupled after 16 hours at 60°F | 3 | 3 | 3 | 3 |
| AATCC #3 Wash Test | | | | |
| Coupled fresh at 60°F | | | | |
| Shade change | good | good | good | good |
| Stain | 4+ | 4+ | 4+ | 4+ |
| Coupled after 16 hours at 60°F | | | | |
| Shade change | fair | fair | fair | fair |
| Stain | 4+ | 4+ | 4 | 4+ |

Rating: 5—Very good
4—Good
3—Fair
2—Poor
1—Very poor

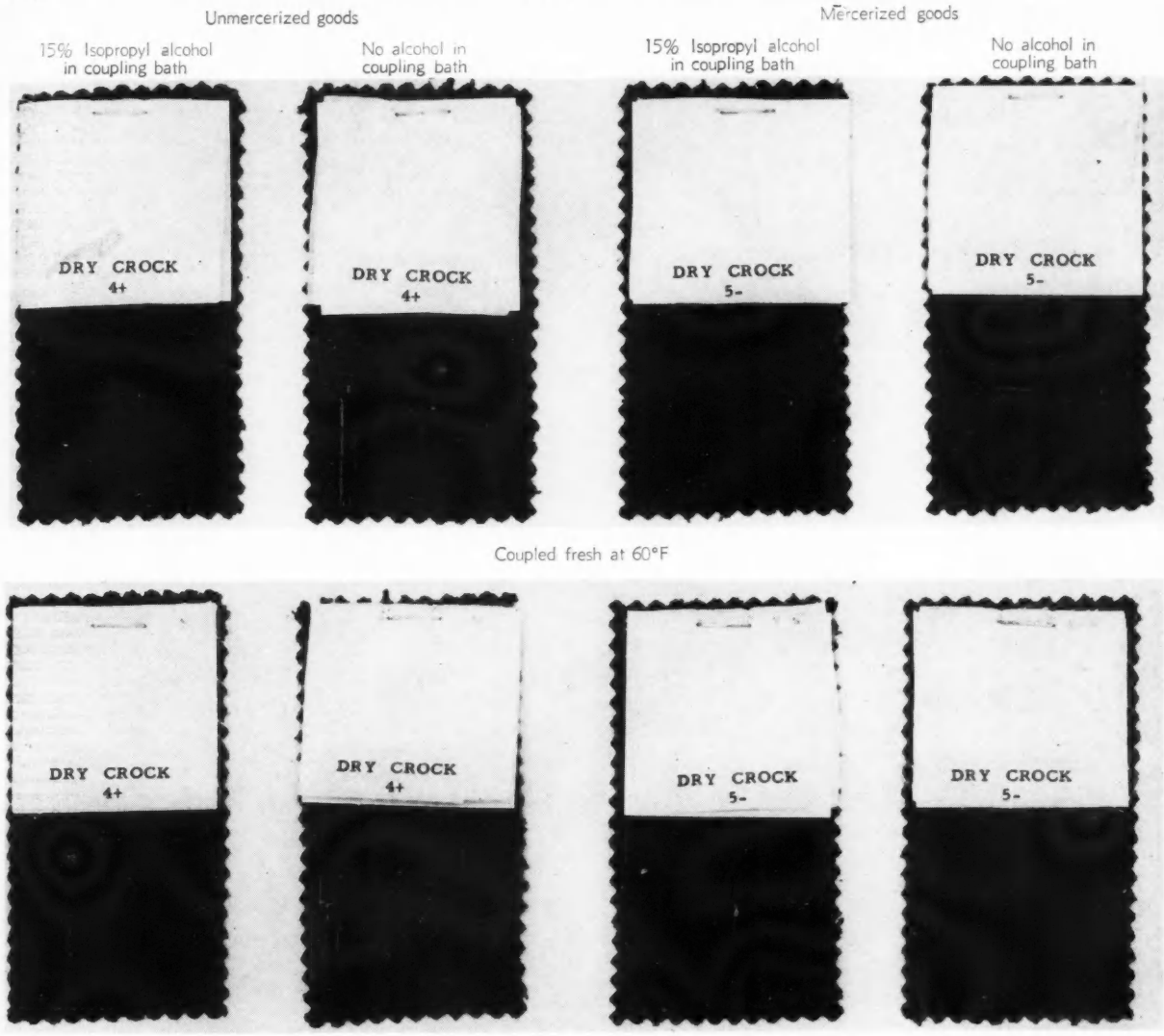



**Figure 6**
**Effect of alcohol addition to coupling bath on unmercerized and mercerized goods**
**Naphthol AS-D and Fast Red KB Base**

able to critically compare the crock fastness of various naphthol-developer combinations, all coupled at a pH of 4.5.

Tests made in section III, A, 1, on bleached sheeting were reviewed, and additional tests made on corduroy by one laboratory using the same procedure as in section III, A, 1, were made for comparative purposes.

2) *Comments.* Combinations of various naphthols with Fast Scarlet R Salt gave same dry crock fastness, as shown in results in Table VI.

Naphthol AS-BR and Fast Red B Salt gave poorest crock resistance of combinations studied, with other combinations better in crock fastness (Figure 7).

Naphthols AS and AS-SW gave good crock fastness in all combinations tested.

3) *Results.* Data show that some combinations give very good crock fastness while others do not.

G) EFFECT OF VARIOUS FINISHES APPLIED TO NAPHTHOL GOODS——

1) *Experimental Tests and Procedure.* In all the literature available on naphthol dyeing, little attention has been given to the effect of finishes on crocking of naphthol-dyed goods.

Therefore, experiments were carried out to study the wide variety of resins, softeners, water repellents, and finishing oils for use on naphthol-dyed fabrics. Tests in this series were made by two laboratories, all tests being made on plant dyed fabrics.

The following procedures were used:

*Cloth:*

Sheeting, Twill, and Corduroy

*Procedure:*

Combination #1—Naphthols AS-

BR and AS-OL coupled with Fast Garnet GBC Base

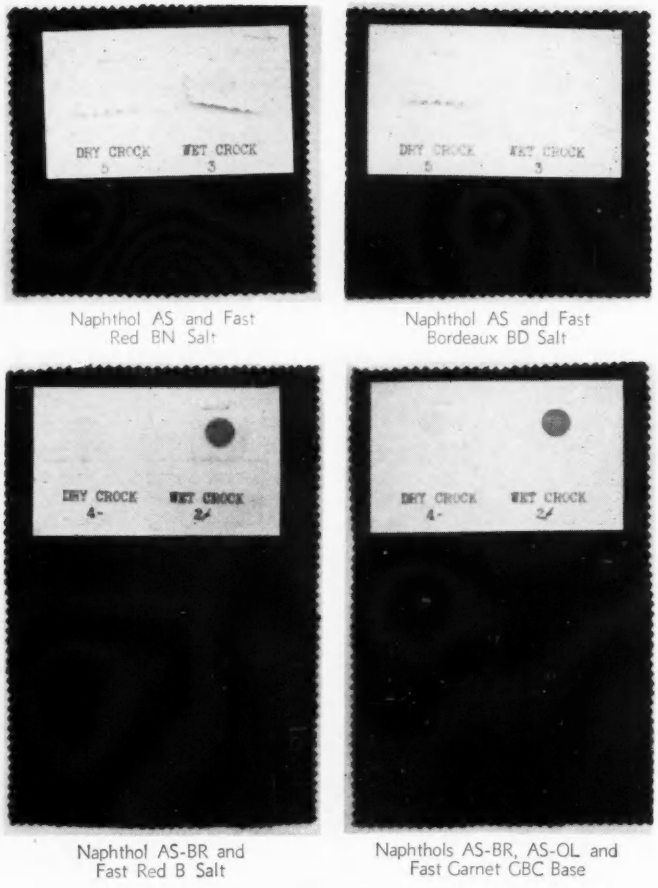
Plant dyed samples were padded with finishes listed below at 140° F, dried and/or cured.

Water blank
5.0% Decetex 104 Emulsion
2.0% Hycar 1512
2.0% Polyvinyl acetate
8.5% Zelan AP Paste
10.0% Zeset S, 2.0% Polyvinyl acetate, 2.5% Zelan AP Paste, 3.3% TLF-576
15.0% Aerotex Resin M-3, 5.5% Decetex 104 Emulsion, 1.5% Aerotex Softener H
13.75% Impregnole AF
6.0% Velubra MS-2, 4.0% Amoline Weighter #45
2.0% Soromine BSA
2.0% Soromine AT
2.0% Softener Finish Z
2.0% Ahcovel G
2.0% Ludox
14.0% Zeset S, 3.0% Zelan AP Paste, 2.6% TLF-576
20.0% Prym, 5.0% Hydropruf, 1.6% Coblefix, 1.0% Ahcovel G

Combination #2—Naphthols AS-BS and AS coupled with Fast Scarlet RC Base

Plant dyed samples were padded with finishes listed below at 140° F, dried and/or cured.

Water blank
13.75% Impregnole AF
6.0% Velubra MS-2, 4.0% Amoline Weighter #45
2.0% Soromine BSA
2.0% Soromine AT
2.0% Softener Finish Z
2.0% Ahcovel G
2.0% Ludox




Naphthol AS and Fast Red BN Salt

Naphthol AS and Fast Bordeaux BD Salt

Naphthol AS-BR and Fast Red B Salt

Naphthols AS-BR, AS-OL and Fast Garnet GBC Base

**Figure 7**
**Effect of Various Dyeing Combinations**

Combination #3—Naphthols BA and AS-PH coupled with Fast Scarlet RC Base

Combination #4—Naphthols AS and AS-BD coupled with Fast Red 3GL Salt

Combination #5—Naphthols AS and AS-BR coupled with Fast Scarlet RC Base

Combination #6—Naphthols AS-BS and BA coupled with Fast Scarlet RC Base

Combination #7—Naphthols BA and AS-PH coupled with Fast Scarlet RC Base (Formula doubled from #3)

Combination #8—Naphthols BA and AS-PH coupled with Fast Scarlet RC Base (Same as #7, but finishing oils increased to 40 lbs./160 gals.)

Plant dyed samples of combinations #3 through #8 were treated with each of the finishing oils listed below.

3.0% Velvatex #75
1.5% Avitone AL (3% for combination #8)

## TABLE VI
## EFFECT OF VARIOUS DYEING COMBINATIONS

**Combinations on Bleached Sheeting—Coupled at pH 4.5**

| Naphthol | Salt | Crock rating Dry | Wet |
|---|---|---|---|
| Naphthol AS-BS | Fast Scarlet R Salt | 4-5 | 3-4 |
| Naphthol AS | Fast Scarlet R Salt | 4-5 | 4-5 |
| Naphthol AS-SW | Fast Scarlet R Salt | 4-5 | 4-5 |
| Naphthol AS-BR | Fast Red B Salt | 4— | 2-3 |
| Naphthol AS-OL | Fast Red B Salt | 4 | 3 |

**Combinations on Corduroy—Coupled at pH 4.5**

| | | | |
|---|---|---|---|
| Naphthol AS-SW | Fast Blue BB Salt* | 5 | 3 |
| Naphthol AS-SW | Fast Orange RDN Salt | 5 | 3-4 |
| Naphthol AS | Fast Orange RDN Salt | 5 | 3-4 |
| Naphthol AS | Fast Scarlet 2G Salt | 5 | 3-4 |
| Naphthol AS | Fast Scarlet R Salt | 5 | 3 |
| Naphthol AS | Fast Red BN Salt | 5 | 3 |
| Naphthol AS | Fast Bordeaux BD Salt | 5 | 3 |
| Naphthol AS-BR | Fast Red B Salt | 4— | 2+ |
| Naphthols AS-BR and AS-OL | Fast Garnet GBC Base | 4 | 2+ |

*Coupled at pH 6.5

Rating: 5—Very good
4—Good
3—Fair
2—Poor
1—Very poor

**Figure 8**
**Effect of various finishes applied to naphthol goods**
**Naphthols AS-BR and AS-OL and Fast Garnet BGC Base**

1.5% **Standopol #16** (3% for combination #8)
2.0% **Profine** (3% for combination #8)
1.5% **Protamine M** (3% for combination #8)
1.5% **Velva Soft**
1.5% **Triton K-60** (3% for combination #8)

2) *Comments.* Results of these tests are shown in Table VII, combinations #1 through #8.

Dry crock tests on plant dyed goods treated with various finishing agents and finishing oils indicate the following results:

Control sample is rated good.

Silicone (water repellent) alone and thermoplastic resins, such as Hycar and Polyvinyl Acetate, do not appreciably affect crocking (Figure 8).

Zelan AP (water repellent) alone without softeners causes considerably more crocking.

Urea-formaldehyde resins and Zelan adversely affect crocking.

Silicone or Permel (water repellent) with melamine resin does not affect crocking when applied without softeners, but causes slightly more crocking when applied with softeners.

Impregnole AF (water repellent) without softeners causes slightly more crocking.

Amoline Weighter (glycol urea compound) and Velubra MS-2 (nonionic softener) cause considerably more crocking.

Soromine BSA, Soromine AT, Softener Finish Z, or Ahcovel G (cationic softeners) alone causes considerably more crocking.

Ludox (colloidal silica) alone causes considerably more crocking.

Silicone or Zelan (water repellents) with urea-formaldehyde resin causes considerably more crocking.

Finishing oils of the sulfonated tallow type tend to cause more dry crocking than sulfonated vegetable oils and cationic softener type. There is very little difference in wet crocking of the various finishing oils (Figures 9 and 10).

If the naphthol-dyed goods have good crock fastness coming out of the dyehouse, the adverse finishing oils make the crocking only a little worse. But if the dyed goods are not very good to crocking, then adverse finishing agents make the crocking much worse. There seems to be very little difference in wet crocking.

The depth of the naphthol shade is important in the crocking obtained after the application of finishing oils as is shown by combinations #3 and #7, where #7 is double formula of #3.

There is a noticeable increase in crocking as the various finishing oils are increased as is shown by the results obtained with combination #8 by increasing all the oils to 40 lbs per 160 gallons.

3) *Results.* Silicone water repellent and thermoplastic resins do not affect crock fastness adversely.

Sulfonated vegetable oils and cationic softener type finishing oils affect crock fastness less than finishing oils of the sulfonated tallow type.

Other water repellents, softeners, resin finishes, and finishing oils tested affect the crock fastness adversely.

## TABLE VII
## EFFECT OF VARIOUS FINISHES APPLIED TO NAPHTHOL GOODS

**Combination #1—Naphthols AS-BR and AS-OL and Fast Garnet GBC Base**

| Finish | Dry crock rating Before treatment | After treatment |
|---|---|---|
| Control—water treated | 4 | 4 |
| 5.0% Decetex 104 Emulsion | 4 | 4 |
| 2.0% Hycar 1512 | 4 | 4 |
| 2.0% Polyvinyl acetate | 4 | 4 |
| 8.5% Zelan AP Paste | 4 | 3 |
| 10.0% Zeset S, 2.0% Polyvinyl acetate, 2.5% Zelan AP Paste, 3.3% TLF-576 | 4 | 3 |
| 15.0% Aerotex Resin M-3, 5.5% Decetex 104 Emulsion, 1.5% Aerotex Softener H | 4 | 3+ |
| 13.75% Impregnole AF | 4 | 2+ |
| 6.0% Velubra MS-2, 4.0% Amoline Weighter #45 | 4 | 3 |
| 2.0% Soromine BSA | 4 | 3 |
| 2.0% Soromine AT | 4 | 3+ |
| 2.0% Softener Finisn Z | 4 | 3+ |
| 2.0% Ahcovel G | 4 | 3+ |
| 2.0% Ludox | 4 | 2 |
| 14.0% Zeset S, 3.0% Zelan AP Paste, 2.6% TLF-576 | 4 | 3 |
| 20.0% Prym, 5.0% Hydropruf, 1.6% Coblefix, 1.0% Ahcovel G | 4 | 3 |

**Combination #2—Naphthols AS-BS and AS and Fast Scarlet RC Base**

| Finish | Dry crock rating Before treatment | After treatment |
|---|---|---|
| Control—water treated | 4+ | 4+ |
| 13.75% Impregnole AF | 4+ | 4 |
| 6.0% Velubra MS-2, 4.0% Amoline Weighter #45 | 4+ | 3 |
| 2.0% Soromine BSA | 4+ | 3 |
| 2.0% Soromine AT | 4+ | 4 |
| 2.0% Softener Finish Z | 4+ | 4 |
| 2.0% Ahcovel G | 4+ | 4 |
| 2.0% Ludox | 4+ | 2+ |

H) EFFECT OF VARYING AMOUNTS OF CAUSTIC SODA IN NAPHTHOL PAD LIQUOR——

*1) Experimental Tests and Procedure.* Dyeings were made on bleached flannels using two different combinations, as listed below. One half of the dyed swatch was soaped at 200° F with synthetic detergent, the other half with chip soap, then processed and tested.

*Combinations*:

1) Naphthol AS-D 20%, 16.6 oz/gal, padded at 180° F, coupled with Fast Scarlet RS Salt, 9.56 oz/gal
2) Naphthol AS 25%, 10.6 oz/gal, padded at 180° F, coupled with Fast Red 3GS Salt, 7.7 oz/gal

*2) Comments.* Data are shown in Table VIII. Use of less than optimum amounts of caustic soda gives shades

## TABLE VIII
## EFFECT OF VARYING AMOUNTS OF CAUSTIC SODA IN NAPHTHOL PAD LIQUOR

| Combination | Amount of caustic added to naphthol solution 0% | 0.5% | 1.5% | 4.0% |
|---|---|---|---|---|
| Naphthol AS-D and Scarlet RS Salt Shade | Light | Light | Full | Full |
| Dry crock rating | | | | |
| Synthetic Detergent* | 4 | 4— | 3+ | 3+ |
| Chip soap** | 5— | 5— | 4+ | 4+ |
| Wet crock rating | | | | |
| Synthetic detergent | 3+ | 3 | 3— | 3— |
| Chip soap | 3+ | 3+ | 3 | 3— |
| Combination | | | | |
| Naphthol AS and Fast Red 3GS Salt Shade | Pale | Very light | Full | Full |
| Dry crock rating | | | | |
| Synthetic detergent | 4 | 4 | 4— | 4— |
| Chip soap | 4+ | 4+ | 5— | 5— |
| Wet crock rating | | | | |
| Synthetic detergent | 3-4 | 3-4 | 3+ | 3+ |
| Chip soap | 4+ | 4 | 3+ | 3+ |

Soaped at 200°F in
* Synthetic detergent solution
1% Fatty amine condensate (96% active)

** Chip soap solution
0.8% Chip soap
0.2% Soda ash
0.2% Fatty alcohol sulfate

Rating: 5—Very good
4—Good
3—Fair
2—Poor
1—Very poor

**Combinations #3 through #8—As Listed Below**

| Combination | #3 Naphthol BA, AS-PH Scarlet RC Base | #4 Naphthol AS, AS-BO Red 3GL Salt | #5 Naphthol AS, AS-BR Scarlet RC Base | #6 Naphthol BA, AS-BS Scarlet RC Base | #7* Naphthol BA, AS-PH Scarlet RC Base | #8** Naphthol BA, AS-PH Scarlet RC Base |
|---|---|---|---|---|---|---|
| Original | | | | | | |
| Dry crock rating | 5 | 4 | 4+ | 5 | 5 | 5 |
| Wet crock rating | 3 | 2+ | 2+ | 3 | 2+ | 2 |
| 3% Velvatex 75 (Sulfonated Tallow) | | | | | | |
| Dry crock rating | 2 | 2+ | 3 | 4 | 2+ | 2 |
| Wet crock rating | 2 | 2 | 2 | 3 | 2 | 2 |
| 1.5% Avitone AL (Sodium Hydrocarbon Sulfonate) | | | | | | |
| Dry crock rating | 5 | 3 | 3+ | 4 | 3 | 3*** |
| Wet crock rating | 3 | 2 | 2 | 3 | 2 | 2 |
| 1.5% Standopol 16 (Sulfonated Vegetable Oil) | | | | | | |
| Dry crock rating | 4 | 3 | 4— | 4 | 3 | 3*** |
| Wet crock rating | 3 | 2+ | 2 | 3 | 2 | 2 |
| 2.0% Profine (Fatty Base Ester) | | | | | | |
| Dry crock rating | 4 | 3 | 4— | 4 | 4 | 3*** |
| Wet crock rating | 2 | 2 | 2 | 3 | 2 | 2 |
| 1.5% Protamine M (Cationic Softener) | | | | | | |
| Dry crock rating | 4— | 3+ | 4 | 4— | 3 | 3*** |
| Wet crock rating | 2 | 2 | 2 | 3+ | 2 | 2— |
| 1.5% Velva Soft (Cationic Softener) | | | | | | |
| Dry crock rating | | 3 | 3 | 3+ | 3— | |
| Wet crock rating | | 2+ | 2— | 3— | 2— | |
| 1.5% Triton K-60 (Tetraalkyl Ammonium Halide) | | | | | | |
| Dry crock rating | 4— | 3+ | 4 | 5 | 4+ | 3*** |
| Wet crock rating | 2 | 2+ | 2 | 3 | 2+ | 2 |

Rating: 5—Very good
4—Good
3—Fair
2—Poor
1—Very poor

* Sample #7 formula double from Sample #3
** Sample #8 same as #7, with finishing oils increased to 40 lbs/gals
*** 3.0% finishing oils were used

Naphthols BA and AS-BS and Scarlet RC Base

Naphthols BA and AS-PH and Scarlet RC Base

**Figure 9**
**Effect of various finishes applied to naphthol goods**

too light for practical use, although crock fastness is slightly better due to less loose color. Use of more than optimum amounts of caustic soda has little effect on crock resistance or shade.

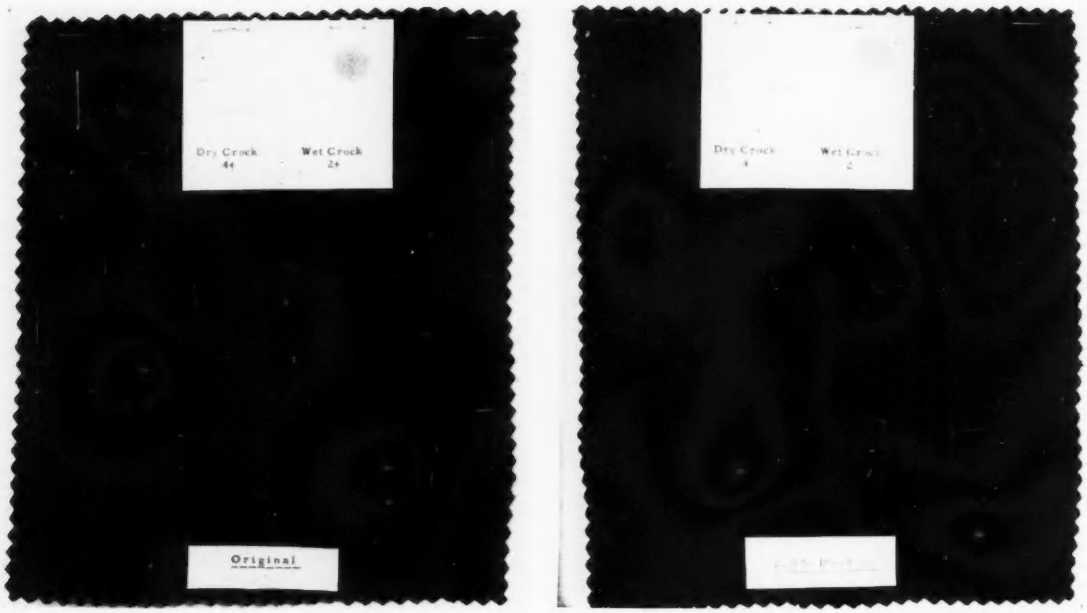
As found in Section III, D, hot soaping in chip soap solution with enough synthetic detergent to prevent calcium soap formation is much better than in synthetic detergent solution alone for removing loose color and improving crock fastness (Figure 11).

3) *Results.* Varying amounts of caustic soda in naphthol solution did not affect crock rating significantly. Use of chip soap in soaping improves crock fastness more than synthetic detergents.

## IV CONCLUSIONS

A) FACTORS FOUND TO CAUSE CROCKING——

The variables studied in these interlaboratory tests include: effect of pH of coupling bath on crocking, effect of temperature and standing time of coupling bath, effect of variations in rinsing with and without steaming the naphthol before coupling, effect of soaping methods with variations in temperature and detergents, effect of alcohol addition to coupling bath on mercerized and unmercerized goods, effect of various dyeing combinations, and effect of various finishes applied to naphthol goods on crocking.




Naphthols AS and AS-BR and Scarlet RC Base

Naphthols BA and AS-PH and Scarlet RC Base (double formula)

**Figure 10**
**Effect of various finishes applied to naphthol goods**

Results from these interlaboratory tests indicate the following:

1) The pH of the coupling bath has very little effect on the crock fastness of the combinations used within the range of pH 3.0-6.0.
2) Drying before coupling gives better crock fastness, and heavier, more uniform shades than wet coupling.
3) The temperature of a fresh coupling bath has very little effect on crocking, but the shade is lighter after longer standing time and high temperatures. Tarring occurs at temperatures above 100° F.
4) Steaming before coupling in these experiments improves crock fastness slightly. Rinsing hot as compared with cold before soaping gives about the same crock fastness.
5) Alkali soap mixtures at higher temperatures are better for soaping naphthols than synthetic detergents or plain water.
6) Mechanical removal of loosely

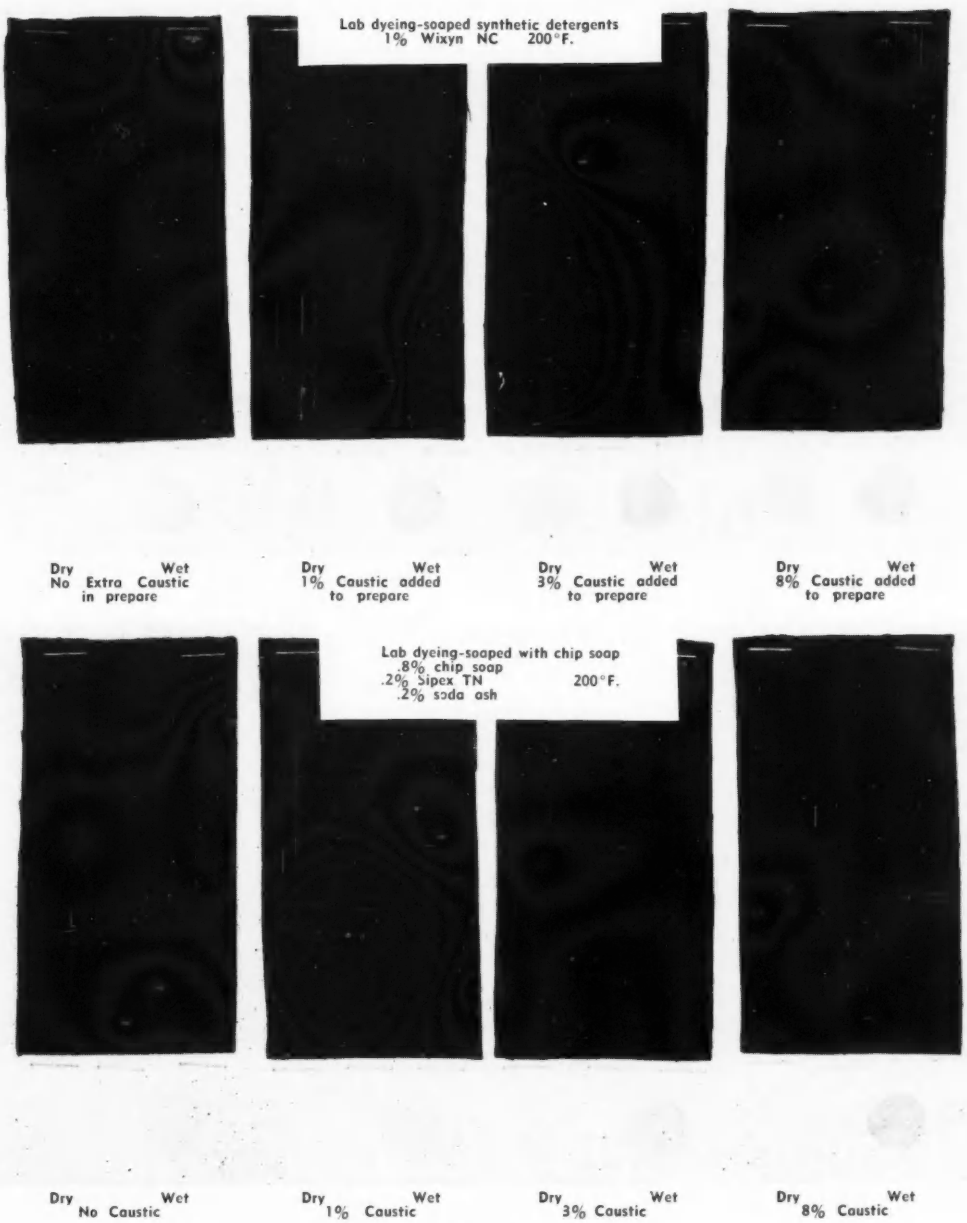



**Figure 11**
**Naphthal Crocking Experiments**
**Effect of varying caustic soda in naphthol pad liquor**
**50 lbs Naphthol AS-D-20% to 50 gals**
**Coupled with 72 lbs Scarlet RS to 120 gals**

held surface particles by brushing improves crock fastness.

7) Adding isopropyl alcohol to coupling bath produces a slightly heavier shade, but does not improve crock fastness.

8) Mercerized goods give a heavier shade and slightly better dry crock fastness than unmercerized goods.

9) Some combinations of naphthols and salts or bases give very good crock fastness while others do not, even when best dyeing procedures are observed.

10) Certain water repellents, resin finishes, and softeners decreased the crock fastness.
Sulfonated vegetable oils and cationic softeners affect crock fastness less than sulfonated tallows.
Silicone water repellent and thermoplastic resins, such as synthetic rubber and polyvinyl acetate, do not lower the crock fastness of naphthol dyed goods. In fact, the thermoplastic resins tend to improve the crock fastness slightly.

Finishes affect some combinations more than others.

11) Varying amounts of caustic soda in naphthol solution did not significantly affect crock rating.

B) METHODS FOUND TO IMPROVE CROCK FASTNESS——

Conclusions point first of all to the proper selection of dye combinations as the best means of producing heavy naphthol dyed shades with improved crock fastness. Next in importance, and a factor which has not been recognized previously, is the selection of a finishing compound that will not cause excessive crocking. The use of chip soap at high temperatures in soaping operation is a third factor found to give definite improvement in crock fastness. Steaming before coupling is recommended for still further improvement in combinations with poor crock fastness. Brushing will remove loosely fixed dyestuff from goods improperly processed. Finally, close control at all times of dyeing, soaping, and rinsing procedures is necessary to maintain maximum crock fastness.

These investigations have resolved the controversial factors believed to cause crocking, and have shown that some of these factors actually contributed to crocking while others did not.

The application of these methods by the dyer will fulfill the requirements stated in the purpose of this paper to satisfy consumer demands and eliminate complaints as a result of improved crock fastness of naphthol dyed goods. The textile industry will thus render a distinct service in supplying the trade with bright, brilliant colors at the same low cost and with the highest possible fastness to crocking as well as washing and light.

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North Carolina Finishing Co
North Carolina State College
U S Rubber Co

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## Perkin Centennial Notes —

(*concluded from page P285*)

intermediates with other raw materials to form the finished product. When foreign sources of supply were cut off, a number of chemical manufacturers started the manufacture of dyes. By 1917, eighty-one concerns were engaged in dye production but the range was limited to those for which the need was greatest. The initial hazards were many; lack of experience, financial barriers and other factors soon eliminated many of the pioneers and by 1937 the number of domestic producers had dropped to forty-three, who produced over 122,000,000 pounds at a sales value averaged at 58 cents per pound.

Today, within a span of about forty years, America is self-sufficient and has a dye industry that is unsurpassed. Its products are the equal of any produced by other nations. Dye-consuming industries have at their disposal an annual production of around 150,000,000 pounds of coal tar colors consisting of more than 1000 different dyes—and which embody degrees of fastness capable of meeting almost every normal requirement. These range from the durable vat dyes that possess outstanding resistance to most color-destroying influences to dyes suitable for application to any of the new synthetic fibers. No longer is royalty the sole owner of colored vestments. The development of synthetic dyes, along with improvements in textile manufacture, allowing mass production of moderately priced fabrics of good quality, has permitted the wide use of color in our daily lives, thus providing the means to a richer, more beautiful, more colorful world.

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## Abstracts

(*concluded from page 282*)

of the light source, 2) the temperature, 3) the surface moisture content.

Regarding the light source, the writer states that although the light from an enclosed carbon arc is very much richer in violet and ultraviolet radiation and deficient in blue, green and red light, compared with daylight, these differences are not as serious as was originally thought, the most abnormal cases being confined to a relatively few dyes whose daylight fastness does not exceed 4.

Anomalous fading due to differences in temperature is uncommon, except in certain types of lamp where excessive heating can cause discoloration, eg, of the newer synthetic fibers.

Regarding surface moisture content, it is obvious that the humidity in the lamp should be the same as the effective humidity in daylight testing. The only fading lamps used in England can be divided into two classes according to whether or not they include a water screen for absorbing the heat from the arc. The screened type of lamp apparently is made only by British manufacturers. Once the heat radiation is removed, it is easy to provide effective humidities (ie, at the surface of the textile being tested) up to 100 percent, and in British lamps this is achieved by passing air over a heatable water tray or by means of an atomizer.

The author believes that more information is needed concerning the effective humidity in daylight, in order to determine what the humidity should be in a fading lamp.—WHC

### New Data on How Eight Fibers Compare in Chemical Resistance

de Bordenave, J F and Bringardner, D J, *Textile World* **106**, 112-24, March, 1956.

A comparison has been made of the fiber-strength loss sustained by eight different fibers when treated with 53 different chemicals.

The fibers studied were acetate, Dacron, nylon, Orlon, rayon, cotton, silk, and wool.

The chemicals used were mineral acids, organic acids, alkalis, detergents, salts, bleaching agents, reducing agents, organic solvents, and miscellaneous chemicals.

The author describes the testing procedures which were employed. All tests were conducted at the School of Textiles, North Carolina State College, under the sponsorship of the du Pont Company.

The results of the tests are presented in tabular form.—WHC

### The Application of Synthetic Resins in Textile Finishing

Ambry, P J, *Textile J Australia* **30**, 372-4, May, 1955.

Synthetic resins are used on textiles for various purposes, including the following:

**1) To modify hand and improve crease recovery.**

**2) To modify fiber and/or fabric resistance to abrasion, tensile stress, and dimensional change.**

**3) To improve fastness to washing, crocking and burnt gas fumes.**

**4) As binders for other finishing agents.**

**5) As coatings for the production of artificial leather cloths.**

**6) As bonding agents for nonwoven fabrics.**

Only the thermosetting resins are discussed at any length in this article, which is confined mostly to urea-formaldehyde (UF) and melamine-formaldehyde (MF). For crease-resistance, MF possesses several advantages over UF, according to the author; eg, greater resistance to washing, equal anti-crease effect with less resin, and lower chlorine retention. It is also applicable to wool. Its textile properties are improved by a modification of the molecule, which is briefly described.

The usual chlorination treatment to prevent wool shrinkage is criticized by the author because of its destructive effect on the wool fiber. The MF acid-colloid process, which is described, is recommended as an improvement, since it does not injure the fibers and has the advantage of adding weight to the wool fiber.

MF can also be used for permanent crisp finishes of nylon, and for embossed effects on cotton.

The author points to the advantages of the thermoplastic resins over starches, etc., as stiffening agents because of their superior washfastness. For a permanently softened crease-resist finish, however, he states that the finisher is virtually limited to quaternary ammonium salts. The insoluble stearamido types are the best for this, he says, as minimal loss in lightfastness is experienced.—WHC

### Recent Developments in Coloring Synthetic Fiber Materials

Hall, A J, *Textile Mercury & Argus* **134**, 18-22, January 6, 1956.

It would appear that so long as synthetic fibers are manufactured from polymeric substances having hydrophobic properties (in contrast to the hydrophile nature of cotton, wool, silk and rayon) there will be considerable difficulties associated with their dyeing and printing.

Those synthetic fibers which are made from acrylonitrile and its copolymers, and in which there is a preponderance of acrylonitrile, have many good textile properties, but such fibers are notoriously difficult to dye except under special conditions. To overcome this, it has in recent years been discovered that increased dye receptivity can be secured in these polyacrylonitrile fibers if they also contain up to ten percent of a vinylpyridine. Such fibers have a much better affinity for acid and direct cotton dyes, and this is attributed to the vinylpyridine component having a basic nature, so that the synthetic fiber becomes more like wool in its dyeing properties. It has been stated that Acrilan is of this type.

The dyeing qualities of these copolymer fibers can also be improved, according to the author, if they are pretreated in a boiling acid solution (eg, 1% sulfuric acid).

Among other items of interest extracted from the patent literature by the author is the statement that the affinity of the polyamide fibers (eg, nylon) for acid dyes may be materially increased by the addition to the dyebath of certain complex quaternary phosphonium salts. At the same time the fibers acquire a softer hand and are resistant to static.—WHC

### New and Modified Fibers Highlight 1955 Synthetic-Fiber Table

London, M, *Textile World* **105**, 83-102, September, 1955.

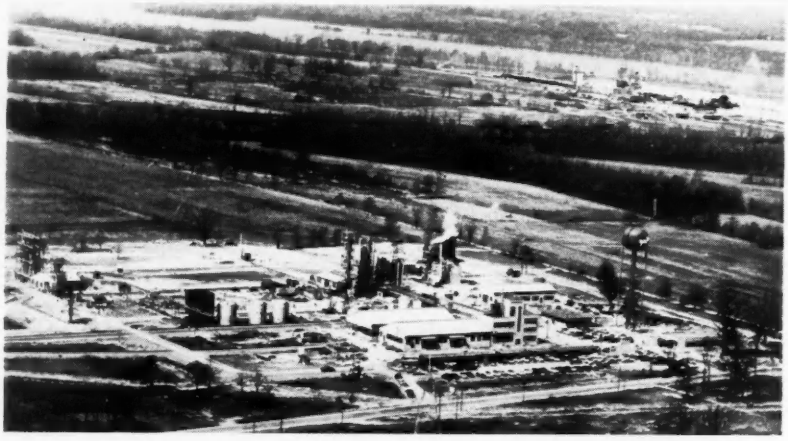
The synthetic fibers available to mills have been broadened in scope since the 1953 revision of this valuable table. The newcomers are Arnel, Fortisan-36, and Type-6 nylon.

Still in the experimental stage are Creslan (formerly X-54), an acrylic fiber of American Cyanamid Co., and Teflon, a tetrafluoroethylene fiber of Du Pont.

The 1955 Synthetic-Fiber Table, under the three main headings Continuous Filament, Staple, and Continuous-Filament Tow, gives the names of all the man-made fibers now being produced in the US, with their respective counts and deniers, and their various producers. A further table lists the 16 main types of synthetics, together with cotton and wool, in parallel columns with their various mechanical and chemical properties, photomicrographs of cross-sections, types of dyes applicable, and suggestions for their individual identification.

This table should be available to every textile chemist.—WHC

# News of the Trade



**"A VAST NEW FIELD OF CHEMISTRY" in this country is represented in this new $6,000,000 high pressure acetylene chemical products plant at Calvert City, Ky, in the opinion of John Hilldring, president of General Aniline & Film Corporation. Manufacture of a line of new acetylene chemical products on a full commercial scale for the first time in the United States is now underway here. The General Aniline operation is the result of 14 years of research, pilot plant production and market development. The products of the plant have already found wide acceptance in a broad range of applications, including dye manufacture, detergent manufacture, etc.**

## 59th Annual Meeting, ASTM

A variety of subjects relating to research and testing of engineering materials will be discussed at the 59th Annual Meeting of the American Society for Testing Materials to be held at Chalfonte-Haddon Hall, Atlantic City, N J, June 17-22. A total of 31 sessions are now scheduled beginning on Monday morning and continuing until Friday noon. Eight symposia are scheduled.

The Marburg Lecture this year will be given by Charles E Reed, general manager, Silicone Products Dept, General Electric Co, Waterford, N Y, on "The Chemical Properties, and Applications of Silicones."

The Society's 12th Exhibit of Testing and Scientific Apparatus and Laboratory Supplies will be an outstanding attraction. At this Exhibit, held every other year, the latest in research and testing apparatus will be displayed.

The President's address, the introduction of new officers, recognition of 40- and 50-year members, and awards of merit will be made at a luncheon session at noon on Tuesday, June 19.

On Wednesday evening, June 20, the annual dinner will provide a "break" in a week otherwise devoted to intensive technical activity. Entertainment will be provided after the dinner by the Philadelphia District Council, host for the meeting. The Council is also planning an attractive program of ladies entertainment.

### NOTICE TO READERS

**With this issue we have made a number of typographical changes that we hope you will like. The most important change is in the main body type. We are now using a slightly larger but less bold type and we are sure that you will find it distinctly more readable. The main type heads on the articles are also new as well as the type heads on the various departments. In addition, there are changes on the front cover and the contents page.**

## NYPC to Meet May 17

The New York Pigment Club will hold its regular monthly meeting on May 17th at 6:30 pm at Fraunces Tavern, New York, N Y.

Benjamin Joachim, technical director, Superior Materials, will speak on "Recent Developments in Aluminum Silicate and Aluminum Magnesium Silicate Pigments.

## Antara Names New Western Distributor

Antara Chemicals, a sales division of General Aniline & Film Corp, has appointed the Denver Fire Clay Co, 2301 Blake Street, Denver, Colo, as the distributor for its products in Colorado, Wyoming, Montana, Utah, Idaho, New Mexico and western Texas, effective April 1.

## Aula Sues Permut

Aula Chemicals, Inc, Elizabeth, N J, has filed suit for injunction in the Superior Court of the State of New Jersey against a former employee, Aaron Permut, who trades as a consultant and also as Solitone Laboratories, 263 Washington Pl, Hasbrouck Heights, N J.

The suit seeks an injunction against Mr Permut and persons acting in concert with him to prevent the use of confidential information and trade secrets acquired while he was an employee of Aula Chemicals, Inc.

* * * *

Mr Permut has denied the charges of the suit and has declared that Aula is attempting to prevent the licensing of his Solitone oil-in-water textile printing inks by this legal action.

## Next GDGA Meeting in NY

The Garment Dyers Guild of America will hold its next clinic and business meeting June 8-9 in New York, N Y.

The host plant will be the Tru-Color Dye Works, Inc, Long Island City.

## Color Assn Elects Four New Directors at 41st Annual Meeting

The Color Association of the United States, formerly The Textile Color Card Association, held its annual membership meeting on Thursday, April 12 at the offices of the organization, 200 Madison Avenue, when four people prominent in the fashion and color industries were elected to the Association's expanded board of directors.

The new members of the board are: Dorothy Shaver, president, Lord & Taylor, and vice-president, Associated Dry Goods Corporation; William G Lord, president, Galey & Lord and vice-president, Burlington Industries, Inc; George E Holbrook, assistant manager, Organic Chemicals Department, E I du Pont de Nemours and Company, Inc, and Eleanor Lambert, president, Eleanor Lambert, Inc.

In addition, the membership re-elected seven directors. They are: John M Hughlett, vice-president, J P Stevens & Co, Inc, who is also president of The Color Association; W Ralph MacIntyre, president, Joseph Bancroft & Sons Co; Newton J Rice, president, Wear-Right Gloves, Inc; Armand Schwab, president, Armand Schwab & Co, Inc; Roy E Tilles, past

president, The Color Association of the U S, Inc; Henry C Van Brederode, president, Earl Loom Fabrics, Inc, and John F Warner, vice-president, D B Fuller & Co, Inc.

Prefacing the annual report made by The Color Association's executive director, Estelle M Tennis, Mr Hughlett cited 1955 as a year of major accomplishment by the Association.

In her annual report covering The Color Association's activities for the fiscal year 1955, Miss Tennis traced the expansion of the organization's services from the textile, millinery and other women's fashion fields to the fields of men's and children's wear, home furnishings, paints, plastics, automobiles, automobile accessories, aircraft, motion pictures, paper products and other industries.

More than 20,000 seasonal color cards and advance swatch sets were issued by the Association during the year, she stated, including woolen and worsted, man-made fibers and silk, hosiery, glove and millinery colors.

The continued wide use of the Association's master color card, the Ninth Edition Standard, for color specification purposes was noted by Miss Tennis. Many technical and scientific societies and various branches of the U S Government use this edition for specifying standard colors.

At a luncheon meeting of the board to welcome the new directors, held at the Empire State Club following the membership meeting, the present officers of The Color Association were re-elected to serve for another year. In addition to Mr Hughlett as president they are: Armand Schwab, 1st vice-president; John F Warner, 2nd vice-president; Estelle M Tennis, secretary and executive director, and Henry C Van Brederode, treasurer.

In addition to the United States, the Association's members are located in thirty-two foreign countries.

## Emery Announces Formation of New Sales Departments

Sparked by a multimillion dollar expansion in research and plant facilities, Emery Industries, Inc., Cincinnati O, has formed two new sales departments to replace the present single chemical sales operation.

Robert F Brown, for nine years sales manager of Emery's present Chemical Sales Department, will head one of the new sections, with Robert Hull and Vern Colby as assistant sales managers. This new group, called the Organic Chemical Sales Department, will handle the sales of all nonfatty Emery products. Included are azelaic and pelargonic acids along

Boyd

Brown

with plasticizers, esters and diesters including those designed for special lubricants, polymerized (dimer) acids, textile processing oils and Twitchell emulsifying bases.

G William Boyd, for the last nine years sales manager of Emery's growing Sanitone Division, becomes sales manager of the new Fatty Acid Sales Department. In addition to Emery's standard fatty products and stearic and oleic, all animal and vegetable fatty acids, hydrogenated fatty acids and glycerides, and derivatives of caster oil will be handled by this group.

## PTI to Offer Course in Textile Management and Marketing

The Philadelphia Textile Institute will present for the 1956 Fall semester a new four-year course of study leading to a BS Degree with a major in Textile Management and Marketing.

Bertrand W Hayward, president, announced that 70% of the academic time will be spent on business administration courses including Economics, Accounting, Marketing, Industrial Relations, Quality Control, Merchandising, Statistics, Market Research and others, in addition to courses in Liberal Arts. The remaining 30 % of the time will be devoted to technological background courses in textiles.

## 57th LTI Alumni Reunion

The 57th annual reunion of the Lowell Technological Institute Alumni association will be held Saturday, May 19, on the Lowell, Mass, campus of the Institute. Alumni who arrive on the preceding evening will be guests at open house parties at all fraternity houses.

Registration will take place Saturday morning from 9 to 11 o'clock in the alumni office, and at 11 an address will be given in Cumnock hall by Martin J Lydon, LTI president. A presentation of awards will be made prior to a brief business session. A catered luncheon will be served at noon in Cumnock hall with members of the graduating class as guests of the alumni.

## 13th Summer Lab Program for Industry

The Polytechnic Institute of Brooklyn has announced the 1956 schedule for its Thirteenth Annual Summer lubricants, polymerized (dimer) acids, Laboratory Program For Industry beginning May 28. Six concentrated courses in laboratory techniques will be offered for industrial researchers.

The one- and two-week courses, with eight hour daily laboratory sessions in addition to evening lectures, will cover the following fields: x-ray diffraction, infrared spectroscopy; polarography; progress in polymerization and copolymerization techniques; properties of macromolecules in solution and ion exchange.

## New Sales-Service Agency For Obermaier Formed

Kragmar, Inc, Paterson, N J, recently sole sales and service agency for Obermaier & Cie, Neustadt a/w Germany, was formed to service and assist all mills using any type of Obermaier equipment made. They have established a technical staff and service department that is prepared to supply technical assistance and provide expert service and necessary replacement parts to any mill requiring these services.

Kragmar, Inc, is ready to offer delivery on any and all new equipment which Obermaier & Cie are currently producing, including the O & C line of the latest machines for every phase of textile work.

Hess

**Raymond W Hess,** coordinator of pollution research for National Aniline Division, Allied Chemical & Dye Corp, will be awarded the 1956 Jacob F Schoellkopf Medal of the Western New York Section of the American Chemical Society at the annual Schoellkopf Award meeting of the Buffalo Launch Club, Grand Island, on May 15th. **Glen B Miller** vice president, Allied Chemical & Dye Corp will introduce the recipient.

## Proctor Roller Curer Helps Oxford Double Output

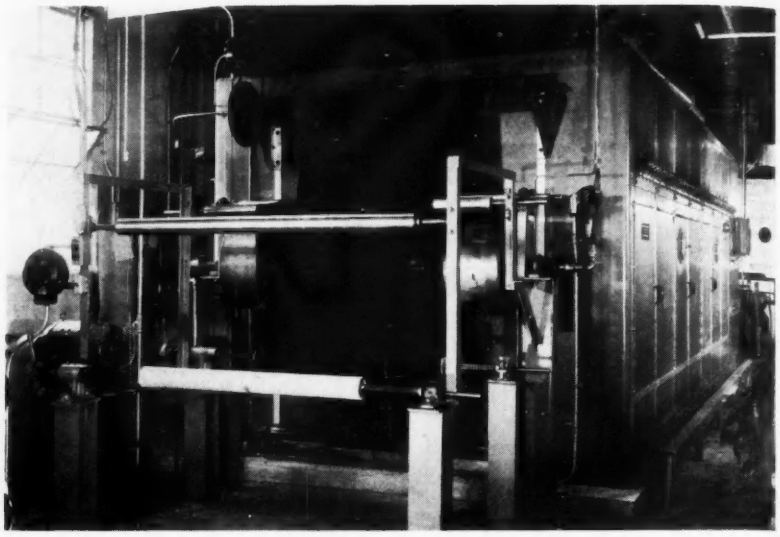
The new Proctor Roller Curer is playing a dramatic role at Oxford Textile Finishing Company's newly modernized plant at Oxford, N J.

At Oxford, installation of a new Proctor Roller Curer, combined with the rearrangement of existing facilities, is reported to have resulted in 35% higher cures with production increased from 50,000 to 105,000 yds/day. In addition, Oxford reports that the new system enables the production of a wider range of better quality finishes. Cost savings are made also through reduction in labor, less waste, and more efficient chemical consumption.

The new curer occupies only 280 square feet of floor space, and is of the new "W/M" construction recently developed by Proctor & Schwartz, Inc. "W/M" construction is said to reduce installation costs, while providing efficient, air-tight and well-insulated housing—smooth, easy-to-clean surfaces. Turbo fan reportedly offers improved air distribution which promotes even, controlled curing without shading.

Prior to installation of the new equipment, Oxford Textile Finishing faced a difficult problem. The bulk of Oxford's production was in the 50-60 lb class, largely gabardines and flannels, for crease-resistant, water-repellent outerwear. Because of changing consumer preferences, demand was swinging sharply toward finishes made with the new, highly durable, abrasion-resistant silicones and other thermosetting or thermoplastic synthetic resins. These new resins were not only more costly, but more difficult to apply and cure, compared to earlier wax base finishes. Extra high temperatures, and critical processing factors taxed the ability of existing equipment. Early attempts to obtain good cures were hampered by this inadequate equipment, excessive handling, due to the criss-cross flow pattern.

Difficulties were encountered at the 3-ton padder, whose pressures were insufficient for correct impregnation of the silicones into the fibers. At the next stage, an open burner tenter gave uneven drying, uncertain operating temperatures with 200° F limit, and consequent low speeds. Replacement of the Palmer Blanket rolls alone is said to have amounted to $8,900 annually. The use of these blankets has been entirely eliminated. Two passes were required in the loop dryer, one for drying and one for curing. These passes and repasses were not only time consuming and costly, but interfered with the normal flow of other goods coming from the dyehouse to be dried. Finally the much-handled cloth had to be framed out with steam to restore the width lost in the dryer. The maximum output of all of this old system was 50,000 yards per 24 hours.



**Installation view of Proctor Roller Curer showing delivery end**

The new flow pattern is marked by simplicity and straight-line, continuous flow. Beginning with a 10-ton padder to secure proper impregnation, the fabric moves through squeeze rolls and preheater to a clip tenter frame where it is dried on one pass. Continuing its straight-line flow, the cloth then moves to a Proctor Roller Curer. The new curer is said to assure uniform curing through uniform air circulation and dual heating stages, which can be preset. Motors are synchronized to maintain curing speed, and tension of the fabric can be adjusted from minimum to maximum while the machine is in operation according to the requirements of the fabric being cured. In the Proctor Roller Curer alternate top rollers are powered by shaded pole motors to convey the cloth with controlled minimum tension through the curing stage.

According to J W Knapik, chief of operations at Oxford, experience is an important factor in obtaining a good cure and equipment must have the versatility and flexibility to respond quickly in control as dictated by the fabric's mill variations, moisture content, etc.

Mr Knapik reports that the Proctor Roller Curer produces 85-95% cures, as compared to only 70% as an industry average.

Garments made from fabrics finished in this machine are said to have an appearance which is far superior to the appearance of garments processed by older methods.

Average running speeds on the new curing line average 35,000 yards per shift, or 100,000 to 105,000 yards per 24 hours, with peaks sometimes reaching as high as 113,000 yards. This is twice as fast as the previous method, with the entire finishing operation being handled by a considerably reduced labor force.

An important adjunct to this high-speed finishing line is Oxford's quality control system. Tests with laboratory accuracy must be performed and results posted quickly. Delay in test results could mean thousands of dollars waste in short periods. Tests include wrinkle recovery, water repellency, wash, odor, and many others. Peter B Fiory, president of Oxford, has stated "Today's consumer is getting a better grade of fabrics than ever before in the durable, crease-resistant and water-repellent field."

Credit for these improvements goes to Mr Knapik, with the close cooperation of Proctor & Schwartz, Inc. As a result of these improved qualities and more uniform finishes, John Gambino, secretary of Oxford, and in charge of sales, stated that, as a result of increased customer confidence in the quality of the finished product, sales have more than doubled since the plant modernization has taken place.

The Oxford Textile Finishing Company has been in its present location for almost a decade, and numbers 155 employees. The plant also utilizes what is believed to be the only "opening machine" of its type in the industry. Designed by Mr Knapik, the machine is said to have reduced the labor required to open cloth after dyeing by 75%.

## MIT Summer Course in Disposal of Industrial Wastes

To review the recent advances in biochemical processing of industrial wastes, a special two-week summer program in Disposal of Industrial Wastes by Biochemical Processes will be given at the Massachusetts Institute of Technology, Cambridge, Mass, from August 20 through August 31, 1956.

Rolf Eliassen, professor of sanitary engineering and director of the Sedgwick Laboratories of Sanitary Science at MIT, will direct the Program. He says that it is planned primarily for chemical engineers, sanitary engineers, and chemists who seek a better understanding of the role of biochemistry, both fundamental and applied, in the processing of organic chemical wastes.

"The program," explains Dr Eliassen, "will cover some of the fundamentals of microbiology and biochemistry, mathematical and analytical techniques employed in waste treatment and stream pollution studies; the principles, design, and operation of aerobic processes such as trickling filters and activated sludge systems, and of anaerotic processes for waste liquors and sludges."

No formal education in biology is required of applicants for the program, Professor Eliassen emphasizes. No particular industry will be stressed; rather, the presentation of principles will lay the groundwork for application to virtually any type of industry.

Lectures and demonstrations will cover the following topics: Principles of microbiology and biochemistry of micro-organisms, characterization of wastes by analytical chemical methods, stream pollution, aerobic and anaerobic biological treatment, sludge concentration and disposal, and pilot-plant design and operation.

Clair N Sawyer, professor of sanitary chem and head of the Sanitary Chem Laboratory, and Ross E McKinny, assistant professor of sanitary engineering and head of the Sanitary Microbiology Laboratory, will assist Dr Eliassen in conducting the program.

Registrants may reserve rooms in the Institute's dormitories during the Program. All MIT recreational facilities are available for their use.

Full details and application blanks may be obtained from the Summer Session Office, Room 7-103, Massachusetts Institute of Technology, Cambridge 39.

## Whytlaw Addresses CATCC Section

The Quebec Section, Canadian Association of Textile Colourists and Chemists, held its annual meeting on April 20th at Montreal with Graeme G Whytlaw, assistant director of the Textile Research Dept, American Viscose Corp, as the featured speaker. In his discussion, Mr Whytlaw outlined textile research and development in the United States.

He opined that the most spectacular development in textiles in this country is probably the growth of the tufted rayon carpet field. When production of carpet rayon mushroomed from a few thousand pounds per year to 100 million pounds in 1955, Mr Whytlaw said, certain problems arose which were successfully met by the work of research and development people. Through strict quality control, excellent carpets are now being made, he declared, emphasizing the importance of proper blending, proper aging of yarn, careful control of size and twist of yarns, avoidance of wet winding or steaming, careful selection of dyestuffs, the pH of the rinsed carpet, and final drying temperature control.

Discussing apparel fabrics, Mr Whytlaw pointed out that blended fabrics are increasing, particularly those of rayon and cotton. "With the fine array of man-made fibers to blend with the natural and themselves," he stated, "an array of useful, beautiful fabrics is being made now."

Speaking of the interest in "wash-and-wear with minimum care," Mr Whytlaw said that blended fabrics will play an important part in this field. He pointed out particularly the need for more effort in developing fabrics combining the hydrophobic characteristics, which permit quick drying, with the hydrophilic factors, which reduce static electricity and promote bodily comfort. Rayon or acetate blended with nylon is an example.

Touching on some of the industrial uses for textiles being developed in the United States, Mr Whytlaw mentioned the increased production of nonwoven fabrics, bonded yarn ribbons of rayon or acetate, and rayon used for paper reinforcement.

Textile research and development has truly unlimited horizons, Mr Whytlaw declared. Almost every advance needs the help and care of the chemists and colorists, he said, for it is their final touch which "gives the fabric color, hand, utility, and glamour."

# General Calendar

**AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE**
Gordon Research Conferences—Textiles Program, July 9-13, Colby Junior College, New London, N H.

**AMERICAN ASSOCIATION FOR TEXTILE TECHNOLOGY, INC**
June 6, Sept. 5, Oct 3, Nov 7, Dec 5 (All meetings at the Vanderbilt Hotel, New York, N Y).

**AMERICAN SOCIETY FOR TESTING MATERIALS**
June 17-22—59th Annual Meeting and 12th Apparatus Exhibit, Chalfonte-Haddon Hall, Atlantic City, N J; Sept 16-22—2nd Pacific Area National Meeting and Apparatus Exhibit, Hotel Statler, Los Angeles, Calif; Oct 16-19—Fall Meeting of Committee D-13 on Textiles, Warwick Hotel, New York, N Y.

**DELTA KAPPA PHI FRATERNITY**
32nd National Convention—April 27-28, Georgia Institute of Technology, Atlanta, Ga.

**THE DRYSALTERS CLUB OF NEW ENGLAND**
May 4 (Hotel Vendome, Boston, Mass); June 22 (Outing, Wachusett Country Club, West Boylston, Mass)

**THE FIBER SOCIETY**
Fall Meeting—Sept 6-7, Warwick Hotel, New York, N Y.

**THE INSTRUMENT SOCIETY OF AMERICA**
11th Annual Instrumentation-Automation Conference and Exhibit—Sept 17-21, New York Coliseum, New York, N Y

**LOWELL TECHNOLOGICAL INSTITUTE**
May 10 (Textile Education and Machinery Day, American Textile Machinery Association annual meeting); May 19 (Alumni Day); June 17—(Baccalaureate and Commencement Activities); Sept 26-28 (Perkin Centennial observance and open house). All events on campus at Lowell, Mass.

**PERKIN CENTENARY**
May, 1956—London, England.

**PERKIN CENTENNIAL**
September 10-15. Waldorf-Astoria Hotel, New York, N Y.

**PHILADELPHIA TEXTILE INSTITUTE**
June 14 (Annual Meeting and Clambake—6 pm—College Campus, Germantown, Pa); June 15 (Outing—Manufacturers Golf & Country Club, Oreland, Pa); June 16(Commencement—College Campus—11 am).

**THE QUARTERMASTER ASSOCIATION**
Annual Convention—Oct 27-28, Conrad Hilton Hotel, Chicago, Ill.

**QUEBEC SECTION, CANADIAN ASSOCIATION OF TEXTILE COLORISTS AND CHEMISTS**
June 16 (Annual golf tournament).

**SILK AND RAYON PRINTERS AND DYERS ASSOCIATION OF AMERICA, INC**
May 25 (Outing, North Jersey Country Club, Wayne, N J).

**SOUTHERN TEXTILE EXPOSITION**
19th Exposition, Oct 1-5, Textile Hall, Greenville, S C.

**SYNTHETIC ORGANIC CHEMICAL MANUFACTURERS ASSOCIATION OF THE UNITED STATES**
May 16-18 (Outing—Skytop, Pennsylvania); June 12, Sept 11, Oct 9, Nov 7 (Palm Terrace Suite, Hotel Roosevelt, New York, N Y).

**TEXTILE TECHNICAL FEDERATION OF CANADA**
5th Bi-annual Textile Seminar—June 5-7, Queen's Univ, Kingston, Ont.

# • NAMES IN THE NEWS •

Dinkins

Swint

**Philip M Dinkins** has been elected a member of the board of directors of General Aniline & Film Corp. He has been vice president-operations, Dyestuff and Chemical Division since joining GAF on June 1, 1955.

**E Rabun Swint** has been appointed manager-executive development for the Dyestuff and Chemical Division. In his new office Mr Swint, who joined GAF in 1953 as personnel relations manager of the Company's Linden dyestuff and chemical plant, will be responsible for the development of an executive management group and staff for the expanding operations of the Division.

**Albert R Buglione** was recently promoted to the position of technical and practical superintendent of Greige, Boil-off and Dyeing Departments at the Pyramid Dyeing Corp, Paterson, N J.

Mr Buglione was formerly greige and dyeing supervisor at De Gise Dyeing Corp, Paterson.

**William F Luther** has resigned as director of research at Dixie Mercerizing Co, and head of the Textile Division of the Industrial Research Institute of the University of Chattanooga to become technical director of the Marler Chemical Co, Cleveland, Tenn.

Dr Luther is the present chairman of the South Central Section, AATCC.

Buglione

Luther

**Jean C LaVey**, formerly production and sales manager for Oscar Heineman Corp, has been named director and executive vice president of Maher Color & Chemical Company, at their new quarters at 1700 North Elston Avenue, Chicago 22, Ill.

**George Strauli**, plant manager of Strauli & Co, Winterthur, Switzerland, toured the Ultra Chemical Works, Inc, plant at Paterson, N J, last month as part of a year-long tour of soap and chemical plants in the United States.

Ultra is an associate of Witco Chemical Company, New York.

Fulbright

Signorino

Clark

Williamson

Ciba Co, Inc has announced the following new sales and technical appointments:

**John W Fulbright**, with Ciba since 1954, has been assigned to the Company's Charlotte, N C, sales force. **John G Signorino** has completed a sales training program and been assigned to the New England Branch.

**John F Clark** and **Jack B Williamson**, both of whom recently joined Ciba, have been assigned as dye technicians with the Charlotte office.

**Ben Purdy** has joined the sales staff of the Harry Miller Corp, Philadelphia manufacturers of textile chemicals.

Mr Purdy will contact accounts in the Philadelphia area.

Warner

Ward

**Robert H Warner** and **William J Ward** have been appointed sales representatives by the Chemical Division of Armour and Company.

Mr Warner's territory covers Wisconsin, eastern portions of Iowa and Minnesota, and the north side of Chicago. He was formerly in the Armour Industrial Oil Department.

Mr Ward will cover northern New Jersey and parts of New York and Pennsylvania. He has been with the Armour Chemical Division a year working in quality control, use and application research, and sales.

**Henry L Young** has rejoined the Textile Colors Division of Interchemical Corp, Hawthorne, N J, as assistant to **William J Rothemich**, Division president.

Mr Young joined Interchemical in 1938, and the following year became associated with the Textile Colors Division, then Aridye Corp. In 1951 he was transferred to the parent corporation, where he has served in various staff capacities.

He is chairman of the Exhibits Committee of the Perkin Centennial.

S Blickman, Inc, Weehawken, N J, has announced the appointment of **Ben Becker** as advertising and sales promotion manager.

Mr Becker was formerly ad manager for Bolsey Cameras.

Young

Becker

Roblin

Parker

Richard O Roblin, Jr and Robert P Parker have been named assistant general managers of American Cyanamid Company's Pigments and Research Divisions, respectively.

Dr Roblin, formerly assistant general manager of the Company's Research Division, has been with Cyanamid since 1934.

Dr Parker, who was formerly director of research at the Pearl River Laboratories, joined the Cyanamid organization in 1933.

Richmond Oil, Soap & Chemical Co, Inc, recently announced the withdrawal of **Frank P Murphy** and **Henry Kline** as president and secretary respectively. They have also severed all financial connections with the company.

**William Alkus** was elected president and **Morton W Levi** secretary.

The Company has consolidated its Southern offices in Charlotte, N C, under the direction of **John Gallman.**

**John W Pool, Jr,** formerly assistant sales manager, has been named manager, Sales Department of the Chemical Division of Koppers Co, Inc. At the same time, **B R Sarchet,** assistant manager of the Sales Department since 1953, was named manager of the Division's Development Department.

Both men were formerly assistant managers of the Chemical Division Sales Department. Mr Pool replaces **Carl H Pottenger,** who was recently appointed vice president and assistant general manager of the Chemical Division, while Mr Sarchet replaces **Frank B Varga,** who was recently appointed a vice president of the newly established Koppers International, C A —an international company handling Koppers overseas activities.

**H D Cooper,** manager of the Division's Eastern District sales in New York, was promoted to assistant manager of the Division's Sales Department. **R F Seubert,** supervisor of the Chemical Division's Sales Office in Pittsburgh, has been named to succeed Mr Cooper.

**R C Boltz** and **J R Hulten** have been appointed division managers and **H P White** has been appointed assistant division manager for Carbide and Carbon Chemicals Company, a Division of Union Carbide and Carbon Corporation.

Mr Boltz has been appointed Eastern Division manager and will be located in the New York office of the company. He was formerly district manager for the Newark District.

Mr Hulten has been appointed Central Division manager and will be located in Cleveland, Ohio. He was formerly district manager for the Philadelphia District.

Mr White has been appointed assistant manager of the Pacific Coast Division and will be located in San Francisco. California. He was formerly district manager for the Chicago District.

Eleven salesmen have been reassigned as follows: **E C Biglow, Jr** to the Cleveland District; **J F Brockman** to the Boston District; **R F Gildehaus** to the Philadelphia District; **P G Horecka** to the Newark District; **D M Neilson** to the New York District; **J E Nimz** to the San Francisco District; **C D Preston** to the New York District; **T L Proctor** to the Albany District; **W R Robertson** to the Newark District; **H L Smith** to the Houston District and **F N Wright** to the Newark District.

**John J Reed** has been named product manager-isocyanates, and **M S Rhodes**, product manager-resin chemicals, by National Aniline Division, Allied Chemical & Dye Corp. Mr Rhodes joined National Aniline as a chemical intermediates salesman in 1953, while Mr Reed has been associated with the Division as nylon plastics coordinator since 1954.

Five appointments in the sales department of Allied's Solvay Process Division have been announced as follows:

**Hugh W Causey,** manager of Solvay's Charlotte sales branch since 1951, has been named an assistant director of sales. **Robert P Baynard,** a salesman at the Charlotte Branch since 1948, succeeds Mr Causey as branch manager. **Robert L Reynolds,** for the past four years technical assistant to the manager of special alkalies, becomes manager of the newly established Organic Chemicals Section; **George R Barclay,** with Solvay since 1950, has been named assistant to manager of Special Alkalies Section; and **Ronald Lovatt,** with Solvay since 1937, assumes the position of supervisor of Calcium Chloride Section.

Parsons

Smith

Sun Chemical Corporation has announced the appointment of **Tarlton F Parsons** to its Warwick Chemical Company Division. Mr Parsons will be responsible for converter and manufacturer relations and the promotion of all Warwick textile chemicals.

**William T Smith** has been assigned to the New York office of the Goodyear Tire and Rubber Company's Chemical Division as sales representative, following a 14-month training program in technical sales and sales service work in the Coatings Department.

The appointments of **Albert P Gagnebin** as manager and **Harold Larsen** as assistant manager of the Nickel Sales Department of The International Nickel Company, Inc, has been announced.

Mr Gagnebin succeeds **Ransom Cooper, Jr,** who is retiring after 33 years' service.

**Thomas C Tarbox** has been appointed technical sales service representative for the Southeastern States by Glyco Products Co, Inc, New York.

He was formerly connected with the sales divisions of the Dewey and Almy Chemical Company and Esso Standard Oil Company.

**Ira J Yocom, Jr** has been appointed assistant manager of United States Testing Company, Inc's Boston laboratories. He was formerly manager of the firm's Memphis Branch laboratory.

In his new capacity he will specialize in the application of improved methods of volume testing of raw and processed wool of all types, and coordinate technical services between the Company's Boston, Philadelphia and Providence laboratories and the main laboratories in Hoboken, N J.

The Chas S Tanner Co, Providence, R I, recently announced the appointment of **E Hays Reynolds** to their Southern textile sales staff. Working from Tanner's southern office in Greenville, S C, he will serve the North Carolina and Tennessee areas.

## Becco Issued Patent For New Bleach Process

Becco Chemical Division, Food Machinery and Chemical Corporation, has announced that U S Patent 2,740,689 for a new type textile bleach process has been issued to B K Easton and W H Kibbel, Jr and assigned to the company. Dated April 3, 1956, the patent describes a continuous hydrogen-peroxide-bleaching process employing an alkaline-hydrogen-peroxide solution containing a polyphosphate and a sequestering agent. Silicates are not employed in the new bleach-bath composition. The new process, according to Becco, will be useful in certain continuous hydrogen-peroxide-bleaching operations where the presence of silicates is objectionable.

## Ranedare Series Insured

Metro-Atlantic, Inc, Centredale 11, R I, has announced that the effective performance of its durable water-repellent series — Ranedare-S, Ranedare-R, and Ranedare-C — is now actually insured by one of the world's largest insurance companies.

Joseph Buonanno, president said he believed this guarantee to be absolutely unique in the water-repellent field. Already, he pointed out, the Ranedare guaranteed-protection plan has aroused considerable enthusiasm in the trade.

The "Insurance Policy" offered by Metro-Atlantic, Inc, is an actual guarantee, in the form of a hang tag to be affixed to every garment treated with Ranedare. The "Insurance Policy" Tag, and the quality-control plan it represents will be backed by a "return-free" merchandising program, as well as large-scale trade and consumer advertising.

## Role of Rhoplex Dispersions in "Wash-and-Wear" Finishing of Cottons Cited

Significant improvements in "wash-and-wear" finishes for cotton may be achieved by the use of Rhoplex thermoplastic resin dispersions in conventional thermosetting resin formulations, according to H C Borghetty, in charge of technical service and new product development in the Rohm & Haas Company's Textile Chemicals Department. Use of the Rhoplex resin along with a thermosetting resin, such as Rhonite R-1, is said to make it possible for the finishes to improve crease resistance with the same fabric strength, or to achieve the same degree of crease resistance with improved fabric strength.

"More and more leading mills are turning to Rhonite R-1 resin treatment," said Mr Borghetty, "to produce cotton fabrics that need only 'touch-up' ironing after washing. Profiting by extensive work in our textile application laboratories, these mills find that they can improve 'wash-and-wear' finishes still further by adding a Rhoplex dispersion to the formulation. Rhoplex is the name of our family of aqueous dispersions of acrylic resins. The addition of any acrylic resin to the formulation makes it possible to improve the crease resistance of a fabric while maintaining the same fabric strength. If it is desired to improve strength, the addition of Rhoplex resin and a reduction in the thermosetting resin will accomplish this without impairing crease resistance."

## Dispersinol C

Dispersinol C, which is described as a highly effective dispersing agent for many types of dyestuffs, has been developed by the research laboratories of the Arkansas Company, Inc.

Anionic in nature and giving a pH of 5.8 to 6.0 in water, it is said to be superior to most other dye-dispersing agents both from the standpoint of rapid action and uniform dispersion of the dyes. In addition to its dispersing properties, it also is said to offer excellent leveling and retarding action for many types of dyes. Arkansas recommends Dispersinol C for use in union dyeings involving a combination of synthetic and natural fibers, such as Dacron-wool blends.

For most applications, the use of 1 to 2% Dispersinol C (on weight of fiber) is recommended for light shades, and 3% for dark shades. For pasting up the dye, it is recommended that Dispersinol C be diluted with a small amount of warm water before adding to the dyebath.

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—TAGALOG FOR
SPECIALIZATION

IN ANY LANGUAGE,
PEERLESS MEANS SPECIALIZATION
PEERLESS COLOR COMPANY, INC.
521-535 North Avenue, Plainfield, New Jersey
Manufacturers of Dye Colors since 1916.
Export Representative: Herbert Lorenz, Inc., World Traders
299 Madison Avenue, New York 17, N. Y.
Cables: HACOLORENZ

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